A star (*) indicates that the Abstract deals with Apparatus and Instruments.

DECEMBER, 1935.

GENERAL PHYSICS.

ADSORPTION.

4744. Sorption of Dimethyl Ether on Alumina. J. Edwards and O. Maass. *Canad. J. of Research*, 13. *Sect. B. pp.* 133–139, *Sept.*, 1935.—The sorption of dimethyl ether on alumina has been investigated at pressures from 0·5 to 52 atmospheres, the critical pressure, over the temperature range 25–135° C. The results are comparable to those for the propylene-alumina system. No discontinuity in the sorption accompanies the transition of sorbate from vapour to gas at the critical temperature; this differs from the previous results for the liquid-to-gas change. The initial stages of the sorption involve the formation of a monomolecular layer, followed, with increasing pressure, by a multimolecular layer of increasing depth. It is unlikely that condensation to liquid occurs in the pores except at high relative pressures. The increase in critical temperature of such a liquid must be exceedingly great to account for the continuous form of the isobars up to 135° C. AUTHORS.

4745. Sorption and Diffusion of Ammonia in Analcim. A. Tiselius. *Zeits. f. phys. Chem.* 174. *Abt.A.* 6. *pp.* 401–423, 1935.—Sorption of NH_3 by powdered analcim is very slow, and it is almost impossible to arrive at equilibrium at temperatures below about 275° C. From the isotherms for 302° and 341·3° C., the heat of sorption is calculated by the Clausius-Clapeyron law to have the constant value 16,640 Cal. for amounts of sorbed NH_3 varying from 5 to 25 c.c. per gm. of material. The phenomenon is probably one of lattice sorption, and approaches very nearly Langmuir's ideal case, but only for small and medium amounts of sorption. Calculation of the sorption volume gives a value more in accord with a molecule oscillating in the lattice than with one freely movable in the whole sorption space. Absolute measurements of the diffusion of the NH_3 have been made on single crystals by an optical method. [See Abstract 2710 (1934).] T. H. P.

4746. Heat of Adsorption of Gases on Zinc Oxide and ZnO–Cr_2O_3. W. E. Garner and F. J. Veal. *Chem. Soc., J. pp.* 1488–1495, *Oct.*, 1935.—Heats of adsorption have been measured for a number of gases on ZnO and ZnO–Cr_2O_3 in the oxidised and in the reduced state. The heats decrease as the surfaces become covered with gas, particularly in the case of the oxidised surfaces. The adsorption of CO and H_2 on oxidised ZnO–Cr_2O_3 involves irreversible processes which occur with the liberation of 45 k.cal./mol. The surface undergoes reduction simultaneously with the adsorption, and H_2 or CO is adsorbed on the reduced areas with heats of 10–15 k.cal. O_2 is also adsorbed on the reduced centres so produced, and a 2 : 1 mixture of CO and O_2 is completely adsorbed by oxidised ZnO–Cr_2O_3. The adsorption of CO, H_2, C_2H_4, and C_2H_6 on the reduced surfaces is reversible and occurs with heats of the order of 10–25 k.cal. Only in cases where there is no penetration of capillaries can the desorption be completed at room-temperature within a reasonable time. From the behaviour on desorption, conclusions are drawn with respect to the activation energies of the adsorption process. A mechanism is suggested for the adsorption on the reduced catalysts. AUTHORS.

4747. Adsorption of Methane by Coal. J. B. Sutton and E. C. H. Davies. *Am. Chem. Soc., J.* 57. *pp.* 1785–1787, *Oct.*, 1935.—The maintenance of the total adsorption system at constant temperature is found to offer advantages of accuracy of measurement and simplicity of calculation. A successful application is made of the Freundlich equation to data found for the adsorption of methane by coal. The calculated heats of adsorption of methane on coal are found to be between 4700 and 5200 cal./mol. for x/m values between 1·5 and 3·5. It is shown that an apparatus equipped with a variable volume unit offers an accurate means of checking adsorption equilibrium on both the adsorption and desorption side of the equilibrium point. AUTHORS.

4748. Adsorption of Hydrogen on Tungsten. J. K. Roberts. *Roy. Soc., Proc.* 152*A*. *pp.* 445–463, *Nov.* 1, 1935.—A method is developed for studying the adsorption of H_2 on a bare W surface which depends on the fact that the accommodation coefficient of Ne is different for a bare surface and for a surface with an adsorbed film on it. It has been shown that saturation occurs at a partial pressure of H_2 of the order of 10^{-4} mm. or lower, or that the process is one of chemi-sorption and takes place rapidly at these low pressures and at 79° K. The heat of adsorption and the amount of gas adsorbed are measured directly on a single fine wire, and the variation of heat of adsorption is traced with variation of the covering of the surface. The film is shown to be stable at negligibly low pressures at room-temperature, and its stability variation with temperature studied. From the measured heat of adsorption and a new desorption formula, the film has been shown to be atomic, with one H atom per atom of W in the surface. Deductions have been drawn concerning the electrostatic forces between the adsorbed atoms and the change in contact potential when a bare surface is covered with a complete H_2 film ; the binding is of the same type as that of O_2 on W. The bearing of the results on the general problem of H_2 adsorption, and, in particular, on the question of activated adsorption is discussed. Values for the accommodation coefficient of Ne on a W surface covered with H_2 are given for 295° and 790° K. [See following Abstract.] H. H. Ho.

4749. Properties of Adsorbed Films of Oxygen on Tungsten. J. K. Roberts. *Roy. Soc., Proc.* 152*A*. *pp.* 464–477, *Nov.* 1, 1935.—The heat of adsorption and amount of O_2 in the well-known stable film are measured, while a second molecular film is found and studied in a similar way. The process of building up an immobile film by the adsorption of the two atoms of a diatomic molecule on neighbouring solid atoms is considered in detail, and, it is shown that such a film necessarily has gaps in it. The number of these gaps has been obtained by an experimental numerical test, and it has been shown that the amount of O_2 in the second molecular film would correspond to adsorption on the gaps in the first film. Other properties of these gaps are discussed, including their possible rôle in the diffusion of O_2 into W, which has been observed in the experiments. The accommodation coefficients of Ne striking the atomic and the molecular film are deduced. [See preceding Abstract and following Abstract.] H. H. Ho.

4750. Composite Films of Oxygen and Hydrogen on Tungsten. J. K. Roberts. *Roy. Soc., Proc.* 152*A*. *pp.* 477–480, *Nov.* 1, 1935.—The adsorption of O_2 on a surface already covered with H_2 is studied, and it is shown that when O_2 is adsorbed H_2 is ejected. The behaviour of H_2 in the presence of a surface partially covered with O_2 is also considered, and the bearing of the results on the problem of activated adsorption is discussed. [See two preceding Abstracts.] H. H. Ho.

4751. Adsorption of Indium and Thallium Atoms on Tungsten Oxide. C. F. Powell and R. L. Mercer. *Roy. Soc., Phil. Trans.* 235*A*. *pp.* 101–124, *Oct.* 31, 1935.—The adsorbed atoms on the surface of a metallic oxide are measured by an electrical method similar to that used by Taylor and Langmuir [see Abstract 5093 (1933)]. The oxide used is the thin skin which forms on W when it is heated in air. The W is a strip (called the filament) 1·3 mm. wide and 0·07 mm. thick running down the centre of the apparatus. By passing the current through this the oxide can be quickly heated, maintained at a constant temperature or rapidly varied in temperature. The filament is bombarded by a stream of neutral atoms of In and Tl from electrical furnaces. When the filament is heated, positive ions leave it and a current passes to the collecting electrodes, reaching an equilibrium value after a known time. It is shown that, of the In and Tl atoms striking the filament a constant fraction, probably equal to unity, is absorbed, and that this fraction is independent of the temperature and the number of atoms absorbed over a wide range. The method enables the electronic work functions of surfaces free from adsorbed atoms to be determined ; 6·13 V is obtained for In, and 6·25 for Tl. As the concentration of the adsorbed atoms increases, the ratio of the positive ion to neutral atom emission increases also, with a linear decrease of the electronic work function. The necessary characteristics of the oxide used as the base for thermionic emission are discussed and the actual characteristics of some oxides are given. H. M. B.

4752. Adsorption of Alkali Metals on Metal Surfaces. Part VI. J. H. de Boer and C. F. Veenemans. *Physica*, 2. *pp.* 915–922, *Nov.*, 1935. *In English.*—For values of the covering fraction $\theta > \theta_m$, that is when atom-atom interactions become more important than ion-atom interactions, a selective photoelectric effect is observed, the spectral maximum of which is situated farther towards long wave-lengths than is observed with the layer bound by ion-atom interactions. [For Parts IV and V see Abstract 3202 (1935).] F. C. C.

***4753. Kathode-Ray Oscillography of Gas Adsorption Phenomena. Parts I and II. M. C. Johnson and F. A. Vick.** *Roy. Soc., Proc.* 151*A*. *pp.* 296–316, *Sept.* 2, 1935.—By connecting the plates of a kathode-ray oscillograph across a resistance carrying a thermionic current, photographic traces are obtained recording the progress of any gas reactions which modify the electron emission from a solid surface. This provides an indicator of such reactions, free from the time-lags inherent in other attempts to measure high-velocity chemical and physical processes at a gas-solid interface. The laws governing the scope and limitations of this method are obtained ; a new time control is described, required for an oscillographic system used for this purpose, and a theoretical and experimental analysis is made of the transient thermal and pressure instabilities which occur when gas is admitted to a high vacuum or the temperature of a solid suddenly raised. Oscillograms exemplifying this analysis are reproduced, selected from the behaviour of O_2 at a W surface. The method is applied to determining the average lengths of time between deposition and re-evaporation of O_2 on W at given high temperatures. The type of adsorption studied is that known to be the most stable attachment of oxygen to a metal surface, whose heat of evaporation between 1850° and 2000° Abs. was estimated as 162,000 cal./gm. atom in an auxiliary use of

Cs by Langmuir and Villars. Using a kathode-ray oscillograph direct measurement is obtained of the much shorter time-intervals between adsorption and desorption at higher temperatures, without using the reaction with Cs. It is found that a linear relation is maintained between the logarithm of these time intervals and reciprocal temperatures, from which is calculable a heat of evaporation of 147,000 ± 3000 cal./gm. atom. The duration of adsorbed state is 0·36 sec. at 2548° Abs. and rises to 3·49 sec. at 2362° Abs. A numerical value of the τ_0 of Frenkel's theory is obtained. Ageing of the W was found to raise the heat of evaporation of the O_2, and certain contamination by added vapours was found to lower it. AUTHORS.

See also Abstracts 4820, 4826, 4872, 4879, 4880, 5087, 5186, 5198.

ATOMIC AND MOLECULAR STRUCTURE.

4754. Nuclear Constitution. K. Nakabayasi. *Zeits. f. Physik*, 97. 3–4. *pp*. 211–220, *Oct*. 11, 1935.—By taking into account the coulomb forces between the nuclear protons as well as the Majorana exchange forces between the neutrons and protons, and assuming that the particle density is to a first approximation constant, a calculation is made by a statistical method of the mass defect and nuclear radius. A comparison made between the experimental and calculated values of the mass defects reveals a general agreement though there is a small systematic divergence. The values of the nuclear radii show good general agreement with the values obtained by Solomon [*Phys. Rev*. 47, 249, 1935] and Pollard [see Abstract 2329 (1935)]. J. E. R. C.

4755. Energies of Nuclear Reactions. H. A. Wilson. *Roy. Soc., Proc*. 152*A*. *pp*. 497–502, *Nov*. 15, 1935.—The energies of 17 nuclear reactions are discussed and revised values of some of the energies are adopted, which make the 17 reaction equations consistent. The energies are shown to be nearly equal to multiples of $q = 0 \cdot 000415$ in atomic weight units. The atomic weights of the 13 light elements involved are calculated from the reaction energies, and values are obtained nearly equal to the values of Bethe and of Oliphant, Kempton, and Rutherford. AUTHOR.

4756. Interaction of Light Nuclei. Part II. Binding Energies of H_1^3 and He_2^3. H. S. W. Massey and C. B. O. Mohr. *Roy. Soc., Proc*. 152*A*. *pp*. 693–705, *Nov*. 15, 1935.—The accuracy of the variation method in dealing with short range interactions is investigated by comparison with exact solutions for H_1^2, and a great variety of trial functions are employed in calculating the binding energy of H_1^3 on the assumption of zero interaction between the neutrons. No function is found which gives a binding energy greater than $5 \cdot 4 \times 10^6$ eV (observed value is $8 \cdot 1 \times 10^6$ eV). Introducing an attraction between the neutrons, it is shown that the observed binding energy can be obtained if this attraction is even smaller than one-third of that between neutron and proton, if the ranges of the interaction in the two cases are comparable. This precludes the possibility of the existence of a stable nucleus n_0^2. Similar calculations for He_2^3 show that an anomalous attraction between two protons at small distances of the same order as that between two neutrons will give the observed binding energy, and consequently the nucleus He_2^2 must be unstable. [For Part I see Abstract 527 (1935).] AUTHORS.

4757. Theory of the Deuton. D. Blochinzew. *Phys. Zeits. d. Sowjetunion*, 8. 3. *pp*. 270–274, 1935. *In German*.—Existing relativistic theory for heavy particles is shown to be adequate to account for the observed binding energy between the proton and the neutron in the formation of the deuton. F. C. C.

4758. Bibliography and Tables of Artificial Transmutations. G. Fea. *N. Cimento,* 12. *pp.* 368–406, *June,* 1935.—Here are collected and tabulated the various transformations which occur in artificial transmutations, when elements are bombarded by protons, neutrons, etc. The Bibliography from which the tables are compiled is added and diagrams are given which represent what is known about stable and radioactive isotopes. H. M. B.

4759. Nuclear γ-Rays of Beryllium. F. Koch and F. Rieder. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 5–6. *pp.* 331–337, 1935.—Previous work has indicated that Be, when bombarded with α-particles, emits γ-rays with energy in the region of 6×10^6 eV. In the present work the emission from Be irradiated with α-particles from Po, is investigated by means of a Wilson chamber in a magnetic field. It is shown that electron pair formation is the principal process involved. The distribution of positrons and photoelectrons is given and indicates the presence of several γ-ray lines. These have energies of $5 \cdot 6$ and $4 \cdot 2 \times 10^6$ (electron pair formation only) and $2 \cdot 6$, $2 \cdot 1$ and $1 \cdot 4 \times 10^6$ eV (electron pairs and photoelectrons). There are also indications of γ-rays of energies $10 \cdot 2$, $3 \cdot 6$ and $1 \cdot 7 \times 10^6$ eV. J. E. R.

4760. Ranges of Particles Emitted by Light Elements under Proton Bombardment. H. Neuert. *Phys. Zeits.* 36. *pp.* 629–642, *Oct.* 1, 1935.—The paper is an account of the measurements, by the cloud-chamber method, of the ranges and range distribution of the particles emitted when elements are bombarded by protons having energies up to 200,000 eV. The particles from B were found to have a continuous range distribution, with a broad, pronounced maximum at 22 mm. and a weak maximum at 44 mm. The existence of a homogeneous group of particles of range $7 \cdot 5$ mm. was established in the case of Be. By using a hydrogen-filled cloud chamber, it was found that the short-range particles from Li consisted of two well-defined groups of range 12 and $8 \cdot 2$ mm., which are ascribed to H^3 and α-particles respectively. No nuclear particle emission was observed in the case of F. W. E. P.

4761. Nuclear Stability of Natural Radioactive Elements. Irène Curie. *J. de Physique et le Radium,* 6. *pp.* 417–419, *Oct.,* 1935.—From a consideration of the disintegration of the isotopes of atomic number 81–92, and the log λ/U ($U = 3A/4-Z$) curve it is deduced that the radio-elements ${}^{233}_{92}R$ and ${}^{229}_{90}R$, of the unknown family with atomic weights of the form $4n + 1$, and which should be derivable from ${}^{237}_{92}R$, should have periods of the order of 10^5 and 500 years respectively, which would account for their being unobservable under present experimental conditions. If UZ has atomic weight 232, *i.e.*, is ${}^{232}_{91}R$, it might be formed from UX_1 and UX_2 according to ${}^{234}_{90}R = {}^{2}_{-1}D + {}^{232}_{91}R$ (1), and ${}^{234}_{91}R = 2{}^{1}_{0}n + {}^{232}_{91}R$, or ${}^{2}_{0}n + {}^{232}_{91}R$ (2 *a* and *b*) respectively, or by neutron irradiation of Pa, $- {}^{231}_{91}R + {}^{1}_{0}n = {}^{232}_{91}R$. If it is formed according to (2*a*) UX_2 should be a strong source of neutrons. C. A. S.

4762. Radioactive Elements Produced by Neutrons. P. Preiswerk and H. v. Halban, Jr. *Comptes Rendus,* 201. *pp.* 722–724, *Oct.* 21, 1935.—On irradiating Tl with neutrons from Rn + Be (800 m. curie), in addition to the activity of 97 min., one of $4 \pm 0 \cdot 5$ min. was observed, shown chemically not to be due to an isotope of Au, Hg or Pb. It is suggested that both are isotopes of Tl, $^{204\,\&\,206}_{81}\mathrm{Tl}$, formed by neutron capture and passing into $^{204\,\&\,206}_{82}\mathrm{Pb}$ by β-ray emission. Sosnowski's results with Bi [see Abstract 1897 (1935] were not confirmed with 1200 m. curie of Rn + Be or 300 of Rn + B. On irradiating P with slowed neutrons from Rn + Be, in addition to activities of 3 and 145 min., one of $15 \pm 1{\cdot}5$ days was observed, due probably to formation of $^{32}_{15}\mathrm{P}$ by neutron capture. C. A. S.

4763. Disintegration of Lithium by Deutons. T. W. Bonner and W. M. Brubaker. *Phys. Rev.* 48. *pp.* 742–746, *Nov.* 1, 1935.—The energy distribution of the neutrons from the disintegration of Li by 0·85 MEV deutons has been determined by the method of recoil protons in a high pressure cloud chamber. The results of the experiment indicate that the neutrons come from the two reactions $_3\mathrm{Li}^7 + {_1}\mathrm{H}^2 \rightarrow 2{_2}\mathrm{He}^4 + {_0}n^1$; $_3\mathrm{Li}^7 + {_1}\mathrm{H}^2 \rightarrow {_4}\mathrm{Be}^8 + {_0}n^1$. The neutrons from the first reaction (95 % of the disintegrations) have a continuous energy distribution, while the neutrons from the second reaction (5 % of the disintegrations) are nearly homogeneous, with a maximum energy of $13{\cdot}3 \pm 0{\cdot}5$ MEV. From these data, the mass of $_4\mathrm{Be}^8$ was calculated to be $0{\cdot}3 \pm 0{\cdot}75$ MEV greater than that of two α-particles. AUTHORS.

4764. Energy of Disintegration of Radioactive Phosphorus ($\mathbf{P^{30}}$). C. D. Ellis and W. J. Henderson. *Roy. Soc., Proc.* 152*A*. *pp.* 714–723, *Nov.* 15, 1935.—The maximum energy of the positrons emitted from radioactive phosphorus P^{30} is determined by measuring the end point of the absorption curve in copper. The value found is $2{\cdot}9 \pm 0{\cdot}1 \times 10^6$ V in good agreement with a previous determination. A careful search was made to see if any γ-rays accompanied the disintegration but none was found besides the annihilation radiation of the positrons. This energy of $2{\cdot}9 \times 10^6$ V therefore determines the difference of energy of the ground states of P^{30} and Si^{30}. Combining this value with other published data, the difference in mass of Al^{27} and Si^{30} is found to be the same when calculated from $_{13}\mathrm{Al}^{27} + {_2}\mathrm{He}^4 \rightarrow {_{14}}\mathrm{Si}^{30} + {_1}\mathrm{H}^1$, or from the two stages $_{13}\mathrm{Al}^{27} + {_2}\mathrm{He}^4 \rightarrow {_{13}}\mathrm{P}^{30} + {_0}n^1$; $_{15}\mathrm{P}^{30} \rightarrow {_{14}}\mathrm{Si}^{30} + \epsilon$. AUTHORS.

4765. Isotopes of Nickel. J. de Gier and P. Zeeman. *K. Akad. Amsterdam, Proc.* 38. 8. *pp.* 810–813, 1935.—Using Thomson's parabola method and pure nickel carbonyl the isotopes 58, 60, 62 and 64 with abundance ratios 68·1, 27·2, 3·8 and 0·9 were found. These results differ qualitatively and quantitatively from Aston's most recent values of 58, 60, 61, and 62 with abundance ratios 67·5, 27, 1·7 and 3·8. F. C. C.

4766. Attempts to Separate Mercury Isotopes. K. Zuber. *Helv. Phys. Acta,* 8.6. *pp.* 488–490, 1935. *In German.*—A partial separation of mercury isotopes is achieved by a photochemical method suggested by Mrozowski [see Abstract 238 (1933)]. This depends on the formation of HgO when a mixture of Hg and O_2 is irradiated, in the present instance the irradiation is limited by a Mrozowski filter to light of the components III and IV of the Hg line 2537 Å corresponding to isotopes Hg^{200} and Hg^{202} respectively. In this case only Hg^{200} and Hg^{202} should form oxides and by subsequent freezing of the Hg and O_2 mixture it should be possible to separate out the uncombined isotopes Hg^{198} and Hg^{204}. In practice it is found that on account of secondary reactions the separation is not possible but with a mixture of Hg, O_2 and N_2 some success is obtained. The ratio $\mathrm{Hg}^{200} + \mathrm{Hg}^{202}/\mathrm{Hg}^{198} + \mathrm{Hg}^{204}$ is measured by means of the absorption of the individual components of λ2537 Å and a definite change in the ratio is found to result from application of the described process. J. E. K.

***4767. Separation of Neon Isotopes by Rectification. W. H. Keesom and J. Haantjes.** *K. Onnes. Lab., Leiden, Comm. No.* 239*b. Physica,* 2. *pp.* 981–985, *Nov.,* 1935. *In English.*—14 rectifications were performed, which took four days each. The lightest neon had an atomic weight of 20·043, the heaviest neon one of 21·157. [See Abstract 537 (1935).]

4768. Emission of Neutrons from Radioactive Sources. C. Y. Chao. *Tsing Hua Univ., Sci. Reports,* 3. *pp.* 221–225, *July,* 1935. *In English.*—Applying Fermi's effect and the chemical separation of the induced radioactive isotope, neutrons are observed from a radon source contained in gold tubes. The number of neutrons emitted is found to be about 2 per millicurie per sec. Owing to the absence of light elements in contact with the radioactive source the neutrons are probably emitted by the radioactive nuclei themselves. AUTHOR.

4769. γ-Rays Produced by Neutron Absorption. F. Rasetti. *Zeits. f. Physik,* 97. 1–2. *pp.* 64–69, *Sept.* 23, 1935.—The quantum energies of the γ-rays emitted when slow neutrons enter atomic nuclei were measured by absorption in Al of the electrons released from Al and Pb by the γ-rays. The coincidence method with two Geiger-Müller counters was used. The quantum energies of the γ-rays for a number of light elements were found to range between 4 and 7×10^6 eV. W. E. P.

4770. Excitation of γ-Rays by Slow Neutrons. S. Kikuchi, H. Aoki and K. Husimi. *Phys. Math. Soc. Japan, Proc.* 17. *pp.* 369–377, *Sept.,* 1935. *In English.*—The paper describes the experiments carried out to detect the γ-rays emitted by various substances under the bombardment of slow neutrons. It was found that Cd, Hg, Au, Cu, Ni and Fe emit γ-rays and an estimate of the cross-section of the neutrons is made. Al and Pb do not emit γ-rays. A further experiment is described which failed to detect the emission of γ-rays when paraffin was bombarded by neutrons and it is concluded that the probability of the combination of proton and neutron with the emission of γ-rays is very small. W. E. P.

4771. Excitation of Secondary γ-Radiation by Neutrons. R. Fleischmann. *Zeits. f. Physik,* 97. 3–4. *pp.* 242–264, *Oct.* 11, *and* 97. 5–6. *pp.* 265–276, *Oct.* 18, 1935. *Zeits. f. techn. Physik,* 16. 11. *pp.* 412–414, 1935.—By means of slow neutrons, retarded in paraffin, H, Fe, Cu, Cd and Pb were excited to the sending out of a nuclear γ-radiation; the absorption of the H γ-radiation in paraffin, Al, and Pb was measured. In all cases examined the γ-radiation was produced by neutrons with small kinetic energy. The phenomena in paraffin, especially the production of slow neutrons, was investigated in various ways. The γ-radiation originates on combination of slow neutrons with H^1 to form H^2; it possesses a quantum energy of $1 \cdot 5 \times 10^6$ eV. The mass of the neutron deduced is 1·0083. The exchange action of neutrons with different substances was investigated. The observation of the neutrons was attained through the γ-rays produced by them. The absorbability of the γ-radiation excited by neutrons was determined in various absorbers. From the absorption coefficients in Al the quantum energy is estimated by comparison with the known radiations of RaC and ThC″. J. J. S.

4772. Disintegration by Slow Neutrons. J. Chadwick and M. Goldhaber. *Cambridge Phil. Soc., Proc.* 31. *pp.* 612–616, *Oct.,* 1935.—All the light elements up to Al and some heavier ones have been examined for disintegration by slow neutrons. Large effects have been found in Li and B and a small effect in N, the reactions being $Li^6 + n^1 \rightarrow He^4 + H^3$, $B^{10} + n^1 \rightarrow Li^7 + He^4$, and probably $N^{14} + n^1 \rightarrow B^{11} + He^4$. The charged particles emitted in the disintegration of Li and B afford a convenient and sensitive indicator for slow neutrons. AUTHORS.

4773. Neutrons Slowed Down at Different Temperatures. C. H. Westcott and H. Niewodniczański. *Cambridge Phil. Soc., Proc.* 31. *pp.* 617–624, *Oct.*, 1935.—Experiments are described comparing the effects of neutrons slowed down in paraffin wax at the temperatures of liquid nitrogen and hydrogen with those obtained at ordinary temperatures. It is found that the absorption produced by certain substances increases as the temperature is lowered. The transformations produced in these substances also increase, but generally to a smaller extent, probably owing to more neutrons being absorbed in the paraffin: the exact figure depends on the thickness of the layer of cooled paraffin. A few experiments were also made substituting liquid hydrogen for paraffin wax (without change of temperature). The effect of this also appears to depend on the thickness of the layer, but it is not yet possible to draw definite conclusions. [See Abstract 2794 (1935).] AUTHORS.

4774. Scattering of Neutrons by Protons. M. Bronstein. *Comptes Rendus (Doklady) de l'Acad. des Sciences. U.S.S.R.* 3. 2. *pp.* 75–78, 1935. *In German.*—The theory of the scattering of neutrons by protons given by Wigner should in one respect be supplemented. Majorana has shown that the energy of alternating action of a neutron and a proton contains as a factor the exchange operator of the local coordination of these particles. This circumstance has remained unconsidered in Wigner's theory. For the symmetrical part of the scattering it is immaterial: only the small unsymmetrical terms, which the deviations of the scattered neutron waves produce in the system connected with the centre of gravity of the symmetry, experience an alteration in consequence of the introduction of the exchange factor. J. J. S.

4775. Scattering of Slow Neutrons by Iron and Other Substances. D. Budnitzky and L. Kurtschatow. *Phys. Zeits. d. Sowjetunion*, 8. 2. *pp.* 170–178, 1935. *In English.*—The length of the free path of slow neutrons in C, Fe, Cu and Pb was found by observing their reflection. The neutrons used in the experiments were obtained from a bulb filled with Ra + Be. This bulb was placed inside a large vessel of water at a distance of about 4 cm. from the surface. The scattering of neutrons was studied by means of a silver target activated near the surface of the water with and without the scattering substance. It is shown that the length of the free path for slow neutrons is smaller than for fast neutrons, and comparison is made with the results of other experimenters. Values of the length of free path for slow and fast neutrons are given in a table. It is concluded that for calculating the values of λ it is necessary to take into account the possible selective sensitivity of the detector of neutrons and the absorption of neutrons in water. J. J. S.

4776. Scattering of Slow Neutrons. A. C. G. Mitchell and E. J. Murphy. *Phys. Rev.* 48. *pp.* 653–656, *Oct.* 15, 1935.—With the radioactivity produced in a silver foil as a detector of neutrons, the scattering of slow neutrons by the metals Fe, Cu, Pb, Sn and Hg has been investigated. Curves showing percentage scattering as a function of thickness are given, from which the relative cross-section for scattering has been calculated. AUTHORS.

4777. Electronic Structures of Polyatomic Molecules. Part XIII. Diborane and Related Molecules. R. S. Mulliken. *J. Chem. Phys.* 3. *pp.* 635–645, *Oct.*, 1935.—Diborane possesses eleven low energy electron states, some singlet and some triplet, belonging to three electron configurations. To account for the colourless, diamagnetic character of B_2H_6, all or most of these eleven states must fall within an energy range of 1·5 V or less, with the lowest state probably of $^1A_1$ type. Derivatives of B_2H_6 have similar structures. The strengths of the bonds involved are discussed, and it is explained why BCl_3 does not form B_2Cl_6. [See Abstract 4050 (1935) and following Abstract.] A. C. M.

4778. Electronic Structures of Polyatomic Molecules. Part XIV. Linear Triatomic Molecules. R. S. Mulliken. *J. Chem. Phys.* 3. *pp.* 720–739, *Nov.*, 1935.—Electron configurations are given for the linear triatomic molecules CO_2, BO_2^-, N_2O, CS_2, COS, NO_2^+, N_3^-, NCO^-, NCS^-, BeF_2, $HgCl_2$, ClCN, ClBO and similar structures. The electron configurations are analogous, and are identical in the case of isoelectronic structures. The ionisation potentials of CO_2, CS_2, N_2O, $HgCl_2$ are discussed in the light of new electronic structures. The minimum potentials of CO_2, CS_2 and $HgCl_2$ correspond to the removal of a nearby non-bonding $p\pi$ electron of the O, S, and Cl atom respectively. The ultra-violet emission bonds of CO_2 probably represent transitions among four electron states of CO_2^+ corresponding to the four lowest ionisation potentials of CO_2. This leads to the conclusion that CO_2^+ also should be linear. A reason for the triangular form of NO_2 is found in the fact that linear NO_2^+ is composed of a stable system of closed shells, and the final electron to make neutral NO_2 would have to go into a high energy antibonding orbital. This is avoided by the rearrangement in triangular form. Ultra-violet absorption spectra of CO_2, CS_2, and COS are also considered. [See preceding Abstract.] A. C. M.

4779. Internuclear Distances and Force Constants of Molecules. R. M. Badger. *J. Chem. Phys.* 3. *pp.* 710–714, *Nov.*, 1935.—The relation between the internuclear distances and force constants found for diatomic molecules is discussed, and is shown to carry over to polyatomic molecules. It is shown that internuclear distances of polyatomic molecules can be predicted from vibrational data alone, with considerable accuracy. AUTHOR.

4780. Molecular Structure of Diiodoethylene. H. P. Klug. *J. Chem. Phys.* 3. *pp.* 747–753, *Nov.*, 1935.—Using data from an X-ray study of the crystal structure of *sym*-diiodoethane and *sym*-diiodoethylene (*trans* form) the positions of the I atoms in the crystal cells were located. Iodine bond resonance is discussed and a factor of 0·92 of the length of the longer bond proposed for evaluating the interatomic distance for any resonating bond. On the basis of the concepts of tetrahedral carbon bonds, bond resonance, Pauling's normal convalent bond radii, etc., reasonable molecular models for the above substances were predicted. Comparison of these with the X-ray data showed the I-I distances to be in excellent agreement with certain I-I distances within the crystal cells, thus locating the molecules within the cells. These models together with Mack's concept of the atomic domain radius of atoms in crystals permitted a consideration of the packing of the molecules in the crystal lattice, thus locating the atomic coordinates of the C and H atoms in the cell. The domain radii found were: I = 1·97Å, and H = 1·23Å. The resulting molecular packing is seen to explain and to be in excellent agreement with observed physical properties of the two crystals. AUTHOR.

4781. Molecular Clustering in Binary Liquid Mixtures. R. S. Krishnan. *Indian Acad. Sci., Proc.* 2*A. pp.* 221–231, *Sept.,* 1935.—The intensity and depolarisation of the light scattered transversely by mixtures of phenol and water in different proportions and at different temperatures are studied. The lowest depolarisation values are obtained with the critical composition mixture (34 % phenol) at the critical solution temperature, and the intensity of scattering increases for this mixture as the critical solution temperature is approached. These results are discussed with reference to anomalies in viscosity, magnetic birefringence, etc., in the vicinity of the critical conditions. C. B. A.

See also Abstracts **4806, 4807, 4825, 4918, 4938, 4943, 4945, 4946, 4968, 4969, 4990, 5007, 5025, 5040, 5063, 5100, 5113, 5120, 5122, 5162, 5181, 5182, 5187, 5189, 5196, 5212, 5214, 5232.**

COLLOIDS.

4782. Influence of Gases on Silver Sols. T. I. Taylor and W. H. Cone. *J. Phys. Chem.* 39. *pp.* 997–1003, *Oct.,* 1935.—A discussion of the methods and difficulties involved in preparing silver sols is given. The influence of gases on silver sols treated in various ways is determined by measurement of precipitation values, cataphoretic velocities, conductances, and colour changes. Gases seem to have a stabilising effect on those sols which are on the border line of stability and which apparently contain secondary particles. Agitation with gases produces a uniform distribution of stabilising ions giving an apparently homogeneous sol. When the secondary particles are broken up, the adsorbed gas apparently prevents their re-formation. No increase in the *average* charge of the particles was observed by measurement of cataphoretic velocities. AUTHORS.

4783. Influence of Ultrasonic Waves on the Colloidal Solubility of Metallic Hydroxides. Part I. N. Sata and S. Watanabe. *Kolloid Zeits.* 73. *pp.* 50–57, *Oct.,* 1935.—It is shown that peptisation of iron hydroxide is greatly increased by the passage of ultrasonic waves. It is possible to peptise iron hydroxide, prepared from ferric chloride and ammonia and washed to negative ionic reactions, without the presence of a peptisator. However, hydroxide precipitated in the presence of excess ammonia and washed merely by decantation is stable in an ultrasonic wave field. The coagulation value of a sol peptised by ultrasonic waves and in the presence of only very small concentrations of peptising agent has been found to be much smaller than for sols prepared by other methods. J. K.

4784. Donnan Effect in Ultrafiltration of Colloidal Solutions. A. Rabinovitsch, P. Vasiljev and T. Gatovskaja. *Comptes Rendus (Doklady) de l'Acad. des Sciences, U.S.S.R.* 3. 3. *pp.* 109–112, 1935. *In English.*—The Donnan equations for membrane equilibrium are made use of to obtain a formula for ultrafiltration of colloidal solutions through a membrane non-permeable for colloidal particles. The formula obtained has been verified in a series of electrometric measurements on various sols of ferric hydroxide as well as on a series of negative sols (WO_3, TiO_2, V_2O_5) and suspensions. The existence of "suspension effect," the apparent constancy of the composition of the ultrafiltrates, and the quasilinear change of the activity of compensating ions in sol residues after ultrafiltration have been found for both systems. J. K.

4785. Formation of Aerosols. N. Fuchs and N. Oschman. *Acta Physicochimica,* 3. 1. *pp.* 61–78, 1935. *In German.*—A method is described for preparing and determining the structure of aerosols, depending on quickly mixing two air streams containing substances capable of reacting with one another, followed by immediate strong dilution. In this way the coagulation of the primary aerosol is substantially avoided. According to this method SO_3 and H_2O vapour (partial pressures of the order of $0 \cdot 1 - 1$ mm.) give a sulphuric acid mist, the reproduction of the particle concentration and also degree of dispersion of which are such as to be unattainable by the ordinary methods of aerosol production. The radius of the droplets (according to weight and particle concentration) is of the order of $1 \cdot 2 - 1 \cdot 5 \times 10^{-6}$ cm. It would appear accordingly that the mist is isodispersed. J. K.

4786. Alkaline Amalgam Electrodes and Their Application to Colloidal Solutions. Z. J. Berestnewa and V. A. Kargin. *Acta Physicochimica,* 2. 2. *pp.* 151–162, 1935. *In German.*—The potentials have been measured for K and Na amalgam electrodes in pure $1 \cdot 0$ to $0 \cdot 01$ N NaCl and $0 \cdot 1$ to $0 \cdot 001$ N KCl solutions. Concentration measurements have been made for Na and K ions in filtrates obtained after As_2O_3 sol has been coagulated with NaCl and KCl. It is shown that alkaline amalgam electrodes are poisoned by the products of hydrolysis of As_2O_3 and accordingly cannot be used for As_2O_3 sol measurements. J. K.

4787. Electrochemistry of Platinum Sols. Natalja Bach and N. Balaschowa. *Acta Physicochimica,* 3. 1. *pp.* 79–96, 1935. *In German.*—Pt-sols, the conductivity of which does not exceed that of the water in which they are prepared, can be produced by the comminution of Pt in a light field, in an O_2–atmosphere, in very pure water ($K = 0 \cdot 2$–$0 \cdot 6 \cdot 10^{-6} \Omega^{-1} \mathrm{cm}^{-1}$). By atomisation in very pure water and in a H_2 atmosphere a very stable Pt sol is obtained, having a conductivity of $0 \cdot 7$–$0 \cdot 8 \cdot 10^{-6} \Omega^{-1} \mathrm{cm}^{-1}$ or 1–$1 \cdot 2 \cdot 10^{-6} \Omega^{-1} \mathrm{cm}^{-1}$ by the application of a.c. or d.c. The conductivity of air-Pt-sols produced by Pennycuick is 10–15 times greater than the water used. This increase is put down, by the present authors, to the production of foreign electrolytes and not $H_2Pt(OH)_6$. The determination of the adsorption of H_2SO_4 by H_2- and O_2-Pt sols has shown that these sols behave as platinised Pt electrodes, as the conversion from H_2-saturation to O_2-saturation takes place reversibly. Catophoretic measurements show that H_2–Pt sols obtained in pure water have a negative electrokinetic charge; their catophoretic velocity is 3–4μ/sec. per Volt/cm. J. K.

4788. Electrochemical Properties of Highly Purified SiO_2 Sols. A. I. Baibajew and V. A. Kargin. *Acta Physicochimica,* 3. 1. *pp.* 97–118, 1935. *In German.*—The conclusion is reached that the usual method of electrodialysis is insufficient for the complete purification of SiO_2 sols. Highly purified SiO_2 sols produced from SiH_4 are neutral. The acid properties of SiO_2 sols described in the literature and purified in the usual manner are caused by the presence of free acid (usually HCl) in the intermicellar fluid of the sols. The activity of the compensating ions in acid as well as in neutral sols is very small, and is below the limit of accuracy of electrometric measurements. J. K.

4789. Electrophoretic Mobilities and Apparent Critical Potentials. H. L. White and Betty Monaghan. *J. Phys. Chem.* 39. *pp.* 925–934, *Oct.,* 1935.—Electrophoretic mobilities of pyrex particles and electroosmotic velocities at a pyrex surface have been measured in several electrolytes over a range of concentrations, and the ζ-values calculated. The electrophoretic mobility is much less than the electroosmotic mobility in dilute solutions, but identical in $M/100$ solutions. This is ascribed to retardation of the particles due to polarisation of the double layer by the applied field. Thus, for acids and polyvalent ions which precipitate in concentrations so small that polarisation may occur, the electrophoretically measured critical potential is lower than the true ζ-potential. It is concluded that the critical mobility in inorganic monovalent salts is a true measure of critical potential, whereas the true ζ-potential in critical concentrations of polyvalent salts is higher than that indicated by mobility, and may be the same as that with monovalent salts. C. J. B. C.

4790. Electrokinetic Potentials at Fused and Unfused Glass Surfaces. H. L. White and Betty Monaghan. *J. Phys. Chem.* 39. *pp.* 935–939, *Oct.*, 1935.—A method is described for the preparation of microscopic glass spheres. The electrophoretic velocity of pyrex spheres is found to be the same as that of unfused pyrex particles. The electrophoretic velocity of pyrex particles (fused or unfused) is much less in dilute solutions than electroosmotic velocity at a fused pyrex surface, the latter being measured by two independent methods. AUTHORS.

4791. Pressure Viscometry Applied to Kaolin Suspensions. G. Fuchs. *Acta Physicochimica*, 3. 1. *pp.* 137–146, 1935. *In German.*—The viscosity of clay suspensions is studied by means of a modification of the capillary pressure viscometer. The concentration of Na-kaolin suspensions strongly influences the process of structure formation. Ageing is due to aggregation which is at first promoted by mechanical action. Structure formation proceeds most actively in suspensions of high dispersion. Dilution of the suspensions results in destruction. Addition of dehydrating agents promotes structure formation and results in increased viscosity. P. H. B.

4792. Viscosity of Aqueous Electrolytes and Lyotropic Numbers. J. H. C. Merckel. *Kolloid Zeits.* 73. *pp.* 67–75, *Oct.*, 1935.—It is shown that the viscosity of electrolytic solutions is a pure lyotropic property. The viscosity of a series of salts having a given kation or anion is always linearly dependent on the lyotropic numbers respectively of anions or kations. As the lyotropic numbers are themselves linearly dependent on the hydration of the ions, it follows that the viscosity of electrolytes is a linear function of the hydration of the ions. In view of the linear relationship between viscosity and lyotropic numbers it is possible to determine the lyotropic numbers of ions and this has been done for Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr, Ba and F. J. K.

4793. Sedimentation Thixotropy for Stabilised Suspensions. N. Jermolenko. *Kolloid Zeits.* 72. *pp.* 312–320, *Sept.*, 1935.—Investigations have been carried out on the stability of suspensions of metal oxides in acidic and alkaline media. For a given medium the stability is found to be in accordance with the Ostwald rule for finely divided materials. The stability maximum of the suspension increases with the amount of metallic oxide for average quantities. Repeated shakings of the suspended precipitate do not alter the stability maximum. The Bungenberg de Jong-Kruyt hypothesis and the author's own views indicate the presence of the Helmholtz double layer in thixotropy and coagulation phenomena. J. K.

See also Abstracts 4820, 4878, 4973, 5021, 5211, 5230.

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CRYSTAL STRUCTURE AND PROPERTIES.

4794. Significant Elasticity and Deformation Coefficients of Crystals with Applications to Isotropy. P. Bechterew. *Zeits. f. Krist.* 92. *pp.* 1–29, *Oct.*, 1935.—Four systems of dimensionless "significant constants" are introduced, leading to the concept of "gradation" of a substance. The "gradations" are illustrative of physical magnitudes such as occur in series relationships. A generalised form of Poisson's coefficient for anisotropic bodies is introduced. F. I. G. R.

4795. Electron Density and Potential in Crystal Lattices. W. E. Laschkarew. *Phys. Zeits. d. Sowjetunion*, 8. 3. *pp.* 227–239, 1935. *In English.*—A method is developed which amounts to working backwards according to the usual process. Instead of finding the electron distribution $\rho(r)$ from a given value of the coefficients f_{hkl}, the method is so to choose $\rho(r)$ that f_{hkl} agrees with observation. [See following Abstract.] F. I. G. R.

4796. Potential Distribution in Crystal Lattices. W. E. Laschkarew and A. S. Tschaban. *Phys. Zeits. d. Sowjetunion*, 8. 3. *pp.* 240–254, 1935. *In English.*—The method [see preceding Abstract] is applied to "equivalent" atoms for the lattices of Li, Al, NaCl and diamond. In constructing the map of potential distribution, the mean potential of the lattice was assumed to be zero. A contribution of 0·01 volt was the limit from an equivalent atom below which the action was neglected. F. I. G. R.

4797. Structure of Lithium-Zinc Alloys. E. Zintl and A. Schneider. *Zeits. f. Elektrochem.* 41. *pp.* 764–767, *Nov.*, 1935.—The system Li-Zn is investigated by the powder method. Five intermediate phases are found. The β' phase (approx. 10 atom % Li) is hexagonal close-packed with $a = 2{\cdot}782$Å, $c = 4{\cdot}385$Å, and $c/a = 1{\cdot}576$. The atomic distribution is statistical. The γ' phase (about 28 atom % Li) has a hexagonal pseudo-cell with $a = 4{\cdot}362$Å, $c = 2{\cdot}510$Å, and $c/a = 0{\cdot}575$. The δ'' phase (LiZn) has the NaTl structure with $a = 6{\cdot}209$Å. J. T.

4798. Structure of Platinum-Thallium Alloys. E. Zintl and A. Harder. *Zeits. f. Elektrochem.* 41. *pp.* 767–771, *Nov.*, 1935.—The solubility of Pt in Tl is very small, as is that of Tl in Pt. Only one intermediate phase is found, with the formula PtTl, and this is investigated by means of X-rays, powder photographs, rotating crystal photographs and Weissenberg photographs being used. The structure is hexagonal with $a = 5{\cdot}605$Å, $c = 4{\cdot}639$Å, and $c/a = 0{\cdot}828$. The atomic positions are given. There are 6 atoms in the unit cell, but owing to the similarity in the X-ray scattering powers of Pt and Tl it is not possible to say whether the atoms are statistically arranged or not. The interatomic distances are somewhat smaller than one would expect from the atomic radii. J. T.

4799. Structure of Lithium Amalgams. E. Zintl and A. Schneider. *Zeits. f. Elektrochem.* 41. *pp.* 771–774, *Nov.*, 1935.—Powder photographs, rotating crystal photographs and Weissenberg photographs are used in the X-ray examination of the Li-Hg system. Five intermediate phases are found, namely, $LiHg_3$, $LiHg_2$, LiHg, Li_2Hg and Li_3Hg. The structures of $LiHg_2$ and Li_2Hg are not obtained. $LiHg_3$ is hexagonal with $a = 6{\cdot}240$Å, $c = 4{\cdot}794$Å, and $c/a = 0{\cdot}768$. The unit cell contains 2 mols. of $LiHg_3$. The atomic positions are given. LiHg has the β-brass structure with $a = 3{\cdot}287$Å. Li_3Hg is cubic with $a = 6{\cdot}584$Å, and has the same structure as Cu_3Al. J. T.

***4800. Aluminium-Zinc Alloys at Elevated Temperatures. E. A. Owen and L. Pickup.** *Phil. Mag.* 20. *pp.* 761–777, *Nov.*, 1935.—Apparatus has been designed to obtain rotation powder photographs of metals and alloys at elevated temperatures *in vacuo* and to obtain accurate measurements of parameter values and temperature. Such apparatus is essential for the X-ray study of the β-phase in aluminium-zinc alloys, owing to its spontaneous decomposition below 270° C., even after severe quenching. Apart from confirming the structure of the phases already given in other investigations, the present work mainly concerns the structure, parameter values, and phase-boundaries above the eutectoid temperature. AUTHORS.

4801. Tin-Antimony and Tin-Arsenic Alloys. G. Hägg and A. G. Hybinette. *Phil. Mag.* 20. *pp.* 913–929, *Nov.*, 1935. *Supplement.*—The structures and homogeneity ranges of the different phases in the systems Sn-Sb and Sn-As are studied by means of X-rays, the powder method being used. The phase corresponding to Sn-Sb has a deformed NaCl structure and is rhombohedral with $r = 6{\cdot}117$ Å and $\alpha = 89{\cdot}70°$, the volume being $228{\cdot}9$ Å^3. With increasing Sb content the volume and deformation of the unit cell increase, and at the limit richest in Sb the rhombohedron has the dimensions $r = 6{\cdot}138$ Å and $\alpha = 89{\cdot}18°$, the volume being $231{\cdot}3$ Å^3. No solubility of As in the Sn phase is detected. Two intermediary phases are found at the compositions Sn_3As_2 and SnAs. Sn_3As_2 is rhombohedral with $r = 12{\cdot}23$ Å and $\alpha = 19{\cdot}22°$, the symmetry being D_{3d}. This rhombohedron contains 7 atoms. The structure probably corresponds to an ideal formula of Sn_4As_3 in which some As atoms are replaced by Sn atoms. The space group is probably D^5_{3d}. Atomic positions are suggested. The phase SnAs has a NaCl structure with $a = 5{\cdot}716$ Å. As dissolves about 21 % (atomic) of Sn. The dissolved Sn causes an increase in the rhombohedral edge and a decrease in the rhombohedral angle of the As phase. J. T.

4802. Atomic Scattering Factors of Nickel, Copper, and Zinc. G. W. Brindley and F. W. Spiers. *Phil. Mag.* 20. *pp.* 865–881, *Nov.*, 1935. *Supplement.*—The atomic scattering factors of Ni, Cu, and Zn for CuKα-radiation have been measured by the powder method using photographic recording of the X-ray reflections. Absolute values of the reflected intensities have been obtained by comparison with reflections from KCl. Two largely independent methods of comparison have been used which have given results in very close agreement. The results are compared with each other, and, in the case of Ni and Cu, with the results of previous observers. A temperature correction has been applied to the observed scattering factors at room-temperature to obtain the scattering factors for the atoms at rest. [See following Abstract.] AUTHORS.

4803. Lattice Distortion in Copper and Nickel Powders. G. W. Brindley and F. W. Spiers. *Phil. Mag.* 20. *pp.* 882–893, *Nov.*, 1935. *Supplement.*—Measurements are made of the atomic scattering factors of Cu and Ni for Cu Kα-radiation, using chemically prepared and filed powders. The values for the filed powders are definitely less than those for the chemically prepared powders, and the extent of the lowering is found to increase with the order of the spectrum. This effect is attributed to lattice distortion caused by filing, and it is shown that the results can be explained on the assumption that the distortion is a random displacement of the atoms from the points of the undistorted lattice. The magnitude of the displacement is found to be $0{\cdot}106$ Å for Cu and $0{\cdot}083$ Å for Ni. Scattering factors for the (200) reflections from both filed powders are reduced much more than can be explained in this way, and this may mean that the distortion of the lattice is not entirely random. [See following Abstract.] AUTHORS.

4804. Lattice Distortion in a Copper-Beryllium Alloy. G. W. Brindley and F. W. Spiers. *Phil. Mag.* 20. *pp.* 893–901, *Nov.*, 1935. *Supplement.*—Using methods previously described [see preceding Abstract] the average atomic scattering factor has been determined experimentally for a Cu-Be alloy containing 0·72 % Be by weight. The results are compared with the scattering factor calculated for the ideal undistorted alloy. The experimental values are less than the calculated values, and the difference increases with the order of the reflection. This is attributed to lattice distortion in the alloy arising partly from the filing process by which the alloy was obtained as a fine powder suitable for X-ray measurements, and partly from the presence of Be atoms in the lattice. The ratio of the observed to the calculated scattering factors can only be partially explained in terms of a random displacement of the atoms from the lattice points; this probably arises mainly from the filing process, for similar results were obtained with the pure metals, Cu and Ni. In addition to the lowering of the observed scattering factor due to a random atomic displacement, it appears that the scattering factors are also lowered by about 4 % and this, it is suggested, may be due to the effect of the Be atoms in the lattice; a tentative explanation is given. AUTHORS.

4805. Examination of Electrodeposited Nickel Coatings by X-Ray Diffraction. W. A. Wood. *Phil. Mag.* 20. *pp.* 964–971, *Nov.*, 1935. *Supplement.*—An X-ray diffraction examination is made of specimens of electrodeposited nickel differing in hardness and initial brightness. The brightness is found to be associated with the degree of selective orientation of the metal grains, and the hardness with the degree of diffusion of the X-ray diffraction spectra. The diffusion of the lines is discussed in terms of fine-grain and lattice-distortion, and the grain size is estimated from the broadening of the spectral lines for a series of deposits of known hardness values. AUTHOR.

4806. Allotropy of Calcium. M. C. Neuburger. *Zeits. f. Elektrochem.* 41. *p.* 790, *Nov.*, 1935.—The X-ray structure of Ca which has been investigated by a number of observers is reviewed. The structures below 300° C. and at 450° C. show that a transition point exists, and the results so far obtained show that there are three, and not four allotropic modifications. Of these, one with a cubic surface-centred lattice of the A1-type, exists below 300° C. The second, between 300° and 400° C. The third, with a hexagonal lattice, A3-type is stable above 450° C. F. J. B.

4807. Allotropy of Phosphorus Pentoxide. A. N. Campbell and A. J. R. Campbell. *Faraday Soc., Trans.* 31. *pp.* 1567–1574, *Nov.*, 1935.—The densities, solution tensions, and solubilities of amorphous, vitreous, and one crystalline form of phosphorus pentoxide are investigated. Of the above three, the only homogeneous form is the vitreous, and this is the most stable, since it has the lowest solubility, and the highest density. It is suggested that as vitreous forms from amorphous, a true solution of amorphous in vitreous is formed as an intermediate product. The properties of this solution have been studied. It is pointed out that if the two allotropes are sufficiently stable to form a true solution, their structural units must be very different. AUTHORS.

4808. Structure of Ferric Phosphate. V. Caglioti. *Accad. Lincei, Atti,* 22. *pp.* 146–148, *Aug.*, 1935.—Compounds of the type ABX$_4$ crystallise fundamentally in the anhydrite and barytes lattice types, both rhombic. Increase in the diameter of B leads to the zircon and monazite types, both tetragonal, and then to the scheelite type. From this the monoclinic wolframite type is obtained by decrease in the diameter of A. By precipitation, aluminium phosphate has been prepared with a structure which is pseudo-tetragonal, but probably rhombic, like crystobalite stable at low temperatures. Ferric phosphate, also prepared by precipitation, has a structure analogous to that of quartz. T. H. P.

4809. Structures of Rubidium and Ammonium Fluoborates. J. L. Hoard and Virginia Blair. *Am. Chem. Soc., J.* 57. *pp.* 1985–1988, *Oct.*, 1935.—$RbBF_4$ and NH_4BF_4 are orthorhombic with *a* 9·07, *b* 5·60, *c* 7·23 Å, and *a* 9·06, *b* 5·64, *c* 7·23 Å respectively; 4 molecules in the unit cell; space group V_h^{16}–*Pnma*. The structure is that of $BaSO_4$ type, and consists of tetrahedra of BF_4^- (B–F = 1·43 Å), and Rb^+ or NH_4^+ ions. Each Rb and NH_4 ion is surrounded by 12F at distances of 2·90–3·46 and 2·83–3·39 Å respectively. The structure of the NH_4 salt is slightly distorted as compared with that of the Rb salt, this is probably due to the formation of H bonds between N and F. [See Abstract 3897 (1933).] C. A. S.

4810. Structure of Thallous Fluoride. J. A. A. Ketelaar. *Zeits. f. Krist.* 92. *pp.* 30–38, *Oct.*, 1935.—The compound is rhombic, space group V_h^{23}, and face-centred. The dimensions are, $a = 5{\cdot}180 \pm 0{\cdot}005$, $b = 5{\cdot}495 \pm 0{\cdot}005$, $c = 6{\cdot}080 \pm 0{\cdot}005$ Å; $a : b : c = 0{\cdot}944 : 1 : 1{\cdot}107$. There are four molecules in the unit cell, and the X-ray density is 8·48. Molecular volume = 26·2. Marked cleavage along (001). F. I. G. R.

4811. Structure of Tetramminocadmium Perrhenate. K. S. Pitzer. *Zeits. f. Krist.* 92. *pp.* 131–135, *Oct.*, 1935.—$Cd(NH_3)_4(ReO_4)_2$ is cubic with $a = 10{\cdot}53$ Å, and 4 molecules per unit cell, space group T_d^2–*F43m*. The 8Re in the unit cell are in two non-equivalent ReO_4 groups, the 4O being arranged tetrahedrally with Re–O = 2·0 and 2·6 Å respectively; each Cd is surrounded tetrahedrally by 4N, Cd–N = 2·1 Å, ReI–ReII = 4·6, Cd–ReI = 5·2, and Cd–ReII = 4·6 Å. The probable structure is figured. The corresponding Zn and Co salts have the same structure, as also probably the similar permanganates. C. A. S.

4812. Sodium Chloride Structure of Li_2TiO_3 and of Its Solid Solutions with MgO and $Li_2Fe_2O_4$. E. Kordes. *Zeits. f. Krist.* 92. *pp.* 139–153, *Oct.*, 1935.—MgO, Li_2TiO_3, and $Li_2Fe_2O_4$ are all isomorphous with NaCl structure, any two or all three forming solid solutions. The lattice constants and refractive indices of any such solution are linearly related to the "molecular" composition, the "molecules" for the purpose of such calculations being $(MgO)_4$, $(Li_2TiO_3)_{4/3}$ and $Li_2Fe_2O_4$. It is hence concluded that all have an averaged structure with the same O skeleton, but cations statistically distributed according to $3Mg^{II} \rightleftharpoons Li_2^{I}Ti^{IV}$, $2Mg^{II} \rightleftharpoons Li^{I}Fe^{III}$, and $3Li^{I}Fe^{III} \rightleftharpoons 2Li_2^{I}Ti^{IV}$. This is explicable by the near equality of the ionic radii (Li 0·78, Mg 0·78, Fe 0·67, Ti 0·64 Å), and "molecular" volumes $(MgO)_4$ 44·8, $Li_2Fe_2O_4$ 43·0, $(Li_2TiO_3)_{4/3}$ 42·7Å^3. The possibilities of such substitutions in regard to refractory materials are discussed, as also their geochemical interest. [See Abstract 1501 (1932).] C. A. S.

4813. Structure of Silver Azide. M. Bassière. *Comptes Rendus,* 201. *pp.* 735–737, *Oct.* 21, 1935.—Silver azide (*d* 4·81) is orthorhombic with *a* 5·58, *b* 5·93, *c* 6·04 Å, and 4 molecules in the unit cell, space group V_h^{26}–*Ibam*. The structure closely resembles that of KN_3 and RbN_3. It is ionic and consists of alternate planes parallel to (100) of Ag and N_3 ions; the latter are linear with N–N = 1·18 Å. C. A. S.

4814. Structure of Hexagonal Silver Iodide. L. Helmholz. *J. Chem. Phys.* 3. *pp.* 740–747. *Nov.*, 1935.—On the basis of oscillation data a structure has been assigned to hexagonal AgI at room-temperature in which the Ag atoms are distributed at random among four positions tetrahedrally surrounding the ideal position in the wurtzite structure. Previous work is discussed and evidence supporting the preference of this structure is presented. At liquid air temperatures the structure is found to approximate closely to that of wurtzite with the ideal parameter value of 1/8. Physical characteristics of AgI are discussed in relation to the proposed structure. AUTHOR.

4815. Structure of the Sugars. Part II. E. G. Cox, T. H. Goodwin and (Miss) A. I. Wagstaff. *Chem. Soc., J. pp.* 1495–1504, *Oct.*, 1935.—X-ray data for a number of crystalline methylated sugars are recorded. From a study of the results in conjunction with others previously published it is concluded that the carbon atoms in the C_5O ring of simple and methylated aldopyranoses are nearly co-planar, the oxygen atom being displaced out of their plane. Reasons are adduced for supposing that the ring form is not appreciably different in solution, and the conformation deduced from the X-ray data is shown to account satisfactorily for various chemical reactions (formation of acetone compounds). The X-ray data confirm the configurations assigned to α- and β-glucose. [For Part I see Abstract 3745 (1935).] AUTHORS.

4816. Structure of Anisotropic Liquids. R. D. Schulwas-Sorokina and M. W. Posnowa. *Phys. Zeits. d. Sowjetunion,* 8. 3. *pp.* 319–325, 1935. *In German.*—Experimental details [see also Abstract 1879 (1935)] and data are given of a method for finding the dependence of the dielectric constant of *p*-azoxyanisole upon low frequencies (200-300 ∼), and therefrom to deduce whether the latter can be related to the structure of this anisotropic substance. It is found that the electrical properties of the liquid remain unchanged at low frequencies, so that the mechanical oscillations found by Zolina [see Abstract 4335 (1933)] to be characteristic of the structure of *p*-azoxyanisole are independent of the electrical properties. H. H. Ho.

4817. X-Ray Investigations of Liquid Crystals. Part V. K. Herrmann. *Zeits. f. Krist.* 92. *pp.* 49–81, *Oct.*, 1935.—The paper commences by enumerating liquid crystalline substances in which phase anomalies can be assumed to account for the optical and X-ray phenomena exhibited near the transition point for rising and falling temperatures [see also Abstract 2704 (1932)]. In this connection, *p*-ethoxybenzal-*p*-aminocinnamic acid ethyl ester, phenylbenzalaminocinnamic acid ethyl ester and terephthalic-bisaminocinnamic acid ethyl ester exhibited a new kind of interference with rising temperature immediately after the solid phase, whose origin is ascribed to light hexagonal cylindrical packing of the molecules within the smectic planes. This interference only occurs at falling temperatures and in the supercooled region for anisal-*p*-aminocinnamic acid ethyl ester and *p*-ethoxybenzalaminocinnamic acid methyl ester. At higher temperatures prior to the transformation into the smectic phase, the interference fades out and this phenomenon is probably due to rearrangements of the molecular configurations. The same substances within the corresponding temperature range give X-ray spectra explicable on the assumption of two liquid crystalline phases which with the nematic phase give one more phase than the Friedel limitation permits. Two viewpoints are expressed to explain the gradual fading out of the interference phenomena which both lead to the same conclusion, but no decision has yet been obtained as to which is the correct hypothesis. The paper includes full experimental details illustrated by photographs and diagrams. H. H. Ho.

4818. Dendritic Growth of Crystals. A. Papapetrou. *Zeits. f. Krist.* 92. *pp.* 89–130, *Oct.*, 1935.—The conditions for dendritic growth have been investigated in detail. The necessary supersaturation was realised by cooling a drop of a solution, saturated at a high temperature, on a microscope slide. Observations on a number of salts are described. The separate points studied include: the part played by diffusion; the effects of surface tension; processes occurring at angles and edges; the development of subsidiary points, and crystallisation from a molten mass. T. H. P.

4819. Growth of Metal Crystals in Metal Vapour. Part IV. M. Straumanis. *Zeits. f. phys. Chem.* 30. *Abt.B.* 2–3. *pp.* 132–138, 1935.—The earlier work on the growth of metal crystals in metal vapour [see Abstract 3115 (1934)] was continued. The growth of homopolar crystals of Te was studied at pressures ranging from 0·01 mm. to 760 mm. and at temperatures below and above the melting point. The crystals were measured and the equilibrium form was determined. Discrepancies were observed in the cases of both Se and Te, from theoretical values for the limits of surface. F. J. B.

4820. Formation and Constitution of Crystals of Lead Salts Containing Water-Soluble Colloid. F. D. Miles. *Roy. Soc., Phil. Trans.* 235*A*. *pp.* 125–164, *Nov.* 20, 1935.—An account is given of the changes in crystal habit and in the stability of the various physical forms and hydrates of lead salts induced by the absorption of the colloid during both slow and rapid precipitation. The adsorption of dextrin on preformed crystals of lead chloride or azide was measured and is compared with the estimated surface available. Ultramicroscopic examination of solutions containing lead chloride and dialysed dextrin, and measurements of their electrical conductivities reveal no evidence indicative of the association of lead ion and dextrin in solution. The results of X-ray examination show that the lattice spacings of the pure salts are unaffected by the introduction of the colloid. The difficulties met in the application of the known X-ray methods of estimating particle-size are discussed, and an approximate correction for an aperture of finite size is deduced. Measurements of the ratio of coherent to incoherent radiation lead to the conclusion that, in the azide (but not the sulphate) complexes, extremely fine (colloidal) lead compound must be present. The general conclusion is that the constitution of the complexes is that of a connected skeletal growth of crystallites, all in nearly the same crystallographic orientation, with layers of colloid between. These layers consist of irregular bundles of long dextrin molecules anchored in the crystallites by some of their hydroxyl groups, but with the remainder free. T. H. P.

4821. Polish-Hardness Experiments upon Dolomite. H. Tertsch. *Zeits. f. Krist.* 92. *pp.* 39–48, *Oct.*, 1935.—A continuation of earlier work upon calcite [see Abstract 62 (1935)]. The distribution of hardness in dolomite in the direction of the cleavage face is totally unsymmetrical: the minimum is in the downward direction from the pole corners. For the basal surface the minimum is perpendicular to the edge between the basal plane and cleavage rhombohedron. F. I. G. R.

4822. X-Ray Measurement of Elastic Strain. R. Glocker. *Zeits. f. Metallkunde*, 27. *pp*. 196–198, *Sept*., 1935.—An X-ray method is described for the determination of the principal axes of strain in an elastically strained body. The method is based on the fact that the lattice dimensions of a body are slightly altered by strain. J. T.

4823. Influence of Photochemical Coloration on Tensile Strength and Solidity of Single Crystals of Rock-Salt. M. Podaševskij. *Comptes Rendus* (*Doklady*) *de l'Acad. des Sciences, U.S.S.R.* 3. 2. *pp*. 71–74, 1935. *In French*.—Exposure to X-rays or ultra-violet light very greatly increases the strength of single crystals of rock-salt (tensile strength by 143·3 %). This increase remains unchanged if the salt so exposed (and coloured) is decolorised by exposure to white light. It is suggested that this increase is due to production of particles showing less dispersion than atomised Na. [See Abstract 40 (1933).] C. A. S.

4824. Lattice Distortion and Photochemical Coloration of KCl Powders. G. W. Brindley, F. W. Spiers, and F. E. Hoare. *Phil. Mag*. 20. *pp*. 1041–1054, *Nov*., 1935. *Supplement*.—The observation that mechanically ground KCl showed much greater photo-coloration than precipitated KCl when irradiated by X-rays, led to the investigation whether the internal cracks or flaws, to which this coloration is attributed, cause appreciable lattice distortion. Measurements of the intensities of X-ray reflections of high order show that grinding produces very little lattice distortion ; the average atomic displacement is not greater than 1 % of the inter-atomic distance of K and Cl in the lattice. The question of extinction is considered in detail. Measurements of the diamagnetic susceptibilities of KCl produced in different ways show that the effect of grinding is to reduce the susceptibility by about 1 % ; the gram-molecular susceptibility of precipitated KCl is $39\cdot3 \times 10^{-6}$ and of ground KCl, $38\cdot8 \times 10^{-6}$. These results show that the much greater photo-sensitivity of ground KCl is not an indication of large lattice distortion and that the internal cracks or flaws, on which the photo-sensitivity is thought to depend, do not give rise to any large distortions of the crystal planes throughout the volume of the crystals. AUTHORS.

See also Abstracts 4780, 4828, 4938, 4949, 5084, 5091, 5124, 5170, 5174, 5177, 5183, 5213, 5222, 5223, 5224, 5226.

DENSITY.

***4825. Density and Compressibility of Silicane and Silicoethane. K. L. Ramaswamy and G. G. Rao.** *Indian Acad. Sci., Proc*. 2A. *pp*. 213–220, *Sept*., 1935.—An apparatus for the simultaneous measurements of densities and approximate compressibilities at ordinary and low temperatures is described. Measurements of densities and compressibilities on monosilane at different temperatures and on disilane at the ordinary temperature were made. The atomic weight of silicon obtained from the corrected molecular weights obtained is compared with the existing values by other authors. AUTHORS.

4826. Densities of Adsorbed Gases. Part I. CO_2 on Charcoal. T. de Vries. *Am. Chem. Soc., J*. 57. *pp*. 1771–1774, *Oct*., 1935.—By using He as an inert gas the density of adsorbed CO_2 on charcoal was determined at 30°. By using Lowry and Olmstead's modification of Polanyi's theory, an ϵ–ϕ curve was calculated. From the experimental results and this curve, it was shown that He did not penetrate the CO_2 layer when its density was more than 0·09 gm. per ml. Polanyi's theory gives densities for the adsorbed layer equal to those observed if the assumption is made that the He penetrates the outer portion of the adsorbed layer. AUTHOR.

4827. Density of Starch. B. Takei. *Kyoto Coll. Sci., Mem.* 18. *pp.* 169–172, *July,* 1935. *In English.*—The net densities of starches are observed by applying the method of perfect evacuation. The density of purified rice starch is found to be 1·646 and that of purified potato starch 1·650. These are the greatest values hitherto observed. AUTHOR.

See also Abstracts 4918, 5092, 5111.

DIFFUSION AND OSMOSIS.

4828. Diffusion in and Structure of Solid Alloys. W. Seith and A. Keil. *Zeits. f. Metallkunde,* 27. *pp.* 213–215, *Sept.,* 1935.—The rate of diffusion, D, of a metal M, in another N, is greater the more M and N differ in size of atoms and chemical properties, are less able to form solid solutions, and as the concentration of M already present in N is greater [see Abstract 1199 (1927)]. D is increased by lowering the melting point, thus D of radioactive Pb in a Pb-Bi alloy is > in Pb, or by anything that renders the packing less close, thus D for Zn or Cu in β-brass is > in α-; but that of Bi in α- and β-Tl-Bi alloys rendered of equal melting point by suitable additions of Bi is the same. Where the components of an alloy have different charges and mobilities an electric current causes change in concentration, thus in an Fe wire partly carburised, the C moves towards the kathode. Any Benedick effect is too small to affect D. C. A. S.

4829. Diffusion of Gases through Metals. Part II. Diffusion of H_2 through Al. C. J. Smithells and C. E. Ransley. *Roy. Soc., Proc.* 152*A*. *pp.* 706–713, *Nov.* 15, 1935.—It is found that H_2 diffuses through Al at a measurable rate at temperatures above 400° C. The rate of diffusion depends on the state of the surface. The highest rate is obtained with a surface freshly scraped in H_2, but it falls off rapidly and after some hours reaches a steady value which is only about one-tenth of the initial rate. This is attributed to contamination of the surface by O_2, since this low rate is obtained with an anodically oxidised surface. The effects of temperature and pressure are satisfactorily represented by Richardson's equation $D = k\sqrt{P}e^{-b/T}$. The value of b for the freshly scraped surface is 15,600 and for the anodically oxidised surface about 21,500. The value of k varies from 3·3 to 0·42 for different states of the surface. [For Part I see Abstract 2378 (1935).] AUTHORS.

See also Abstracts 4745, 4938, 5093, 5250.

ELASTICITY AND PLASTICITY.

4830. Two-Dimensional Problems of Elasticity Connected with Triangular Plates. B. Sen. *Calcutta Math. Soc., Bull.* 26. *pp.* 65–72, *June,* 1934. *In English.*—Trilinear coordinates being employed, the following matters relating to a plate having the form of an equilateral triangle with supported edges are discussed: (1) bending under normal pressure, (2) transverse vibration, (3) buckling under uniform edge thrust. J. S. G. T.

4831. Pressure Distribution Throughout an Elastic Stratum. W. Passer. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 5–6. *pp.* 267–275, 1935.—The complete solution for the pressure distribution throughout an infinite elastic stratum, obeying Hooke's law and supported on an infinitely rough plane is derived mathematically. The formal results obtained do not agree with those of Carothers (Proc. Int. Math. Congress, 1924, Vol. 2, pp. 527–549) as the latter is derived by taking into account one boundary condition only; the present work comprehends two boundary conditions. Special attention is directed to the stresses in the plane of separation between the stratum and its support. J. S. G. T.

4832. Deflection of Beams. S. R. Sen Gupta. *Indian Phys.-Math. J.* 6. *pp.* 51–53, *Sept.*, 1935.—An expression is first obtained for the deflection at any point with unit load at any distance from the origin. When the load is distributed the individual values can be integrated. Concentrated loads are dealt with graphically and for dynamic loading a curve is obtained showing the deflection at any point on the beam for all positions of the travelling load. The method has been applied with success to cantilever and beams with terminal couples and to continuous beams. R. S. R.

4833. Spread of Force in the Half-Plane and Half-Space for Anisotropic Materials. K. Wolf. *Zeits. f. angew. Math. u. Mechanik*, 15. *pp.* 249–254, *Oct.*, 1935.—A mathematical investigation is made of the distribution of stress due to applied forces on material whose elastic coefficients are different in two directions at right angles. G. C. M. V.

4834. Breaking Load of a Flat Strip. C. Schmieden. *Zeits. f. angew. Math. u. Mechanik*, 15. *pp.* 278–285, *Oct.*, 1935.—This investigation has for its objective the calculation of the breaking load of an infinitely long flat strip by simultaneous consideration of the thrust and pressure forces in its plane. The paper is divided into the following sections: (1) the differential equation and its solution; (2) discussion of the breaking equation; when the boundary conditions are known for both cases, four homogeneous linear equations are obtained for the four integration constants, which only possess a solution differing from zero when the determinant of the coefficients vanishes: this determinant equated to zero constitutes the breaking-equation; (3) pressure only along the length and cross-section; (4) pressure and thrust; (5) pressures in conjunction with small thrusts. The paper is mathematical throughout. H. H. Ho.

4835. Scratch Hardness of Toughened Plate Glass. A. J. Holland and W. E. S. Turner. *Soc. Glass Technol., J.* 19. *pp.* 221–230, *Sept.*, 1935.—A description of experiments made, under five different sets of conditions, on the cuts or scratches produced on both ordinary plate glass and on toughened (armourplate type) glass. In three, the cutting agent was a diamond; in two, a tungsten alloy wheel, different loads being used in different cases. Under the same cutting conditions, the width of scratch was nearly the same for ordinary plate as for toughened glass, but whereas it was uniform all over the surface of ordinary plate, the width diminished by approximately 25 % near the edges of the toughened sheet. The note emitted by the cutting tool was different in the two cases. The cut was cleaner with the toughened glass; but after an interval of time, in length dependent on the cutting load, the sides of the cut underwent splintering. The splinters produced were curved, and from this curvature calculations were made which indicated that the tensile stress at the centre of the sheet varied from $1\cdot0$ to $5\cdot3 \times 10^4$ kg./cm.^{2}. Numerical data and photomicrographs are given. AUTHORS.

4836. Changes in Rigidity and Internal Friction of Amorphous Silica with Temperature. K. Iida. *Tokyo Univ. Earthquake Research Inst. Bull.* 13. *pp.* 665–680, *Sept.*, 1935. *In English.*—Uniform fibres, drawn from bars of quartz, are stretched by loads and then submitted to torsional vibration. From the period of oscillation and the logarithmic decrement the torsional rigidity is found and the coefficient of internal friction estimated. The experiments are carried out at atmospheric and lower pressures to eliminate air resistance. Results show that the rigidity increases with temperature to a maximum at about 1000° C. For fibres of smaller diameter, the modulus of rigidity increases and the maximum occurs at a lower temperature. The coefficient of internal friction is of the order 10^5 in c.g.s. units at the room-temperature; it increases at first uniformly with increasing temperature but more rapidly at about 600° C. This coefficient is also larger for fibres of smaller diameter, but it is reduced by annealing. H. M. B.

4837. Compressibilities and Apparent Volumes of Salts in Solution. Part II. A. F. Scott and G. L. Bridger. *J. Phys. Chem.* 39. *pp.* 1031–1039, *Oct.*, 1935.—New measurements of the densities and compressibility coefficients of concentrated solutions of lithium chloride and bromide are reported. On the basis of these and previous measurements, the irregular properties of the concentrated solutions of these electrolytes are discussed. A graphical method for calculating the factor $f\left[=\left(\frac{\partial\phi}{\partial c}\right)_P\frac{dc}{dP}\right]$ is described. [For Part I see also Abstract 575 (1935).] AUTHORS.

4838. Isotherms of Methane from 0°–150°C. A. Michels and G. W. Nederbragt. *Physica*, 2. *pp.* 1000–1002, *Nov.*, 1935. *In English.*—The isotherms of methane are determined by a similar method to that previously used for N_2 [see Abstract 2734 (1934)]. The results are tabulated at intervals of 25° C. over the temperature range 0° to 150° C., for 8 densities d, ranging from approximately 19 to 53 Amagat units. At each of these temperatures equations are derived of the form $pv = A + Bd + Cd^2 + Dd^4$, and the values of the constants are tabulated. These coefficients are also determined as functions of the temperature, so that an equation of the above form can be used for the calculation of pv at any temperature and density. R. W. P.

4839. Photoelastic Study of Percussions. J. Thouvenin. *Comptes Rendus*, 201. *pp.* 769–771, *Oct.* 28, 1935.—A brief description of the photoelastic investigation of a glass plate subjected to shock by transmission. A weight is allowed to fall on a steel knife edge on to the edge of a vertical glass plate, and the resulting stresses are recorded photographically at intervals of 1/4,000 sec. Typical photographs are reproduced. R. L.

4840. Bending Vibrations of a Ring. K. Federhofer. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 5–6. *pp.* 307–315, 1935.—Since, when a straight rod oscillates with high frequency, it is known that the inertia due to bending and the outward thrust cause considerable influence on the vibrations, differential equations are here obtained which completely represent the factors involved in the vibrations of a thin ring. The equations are solved, numerical values are found for the three subsidiary influences, and tables and graphs are given to show how these influences are affected by frequency. H. M. B.

4841. Vibration of an Elastic Column. J. G. Jagger. *Phil. Mag.* 20. *pp.* 997–1000, *Nov.*, 1935. *Supplement.*—If an elastic column be subjected to any distribution of axial forces, p per unit length, then by expressing p in the form of a Fourier series the particle displacement, U_x, and stress, f_x, at any point along the column can be determined. The method also allows account to be taken of damping. Values of U_x and f_x

are determined for the case of a column fixed at one end, free at the other and subjected to a suddenly applied force. J. S. G. T.

4842. Increased Strength of Thin Filaments. S. Jurkov. *Techn. Phys. U.S.S.R.* 1. 4. *pp.* 386–399, 1935. *In English.*—The author discusses the increased mechanical strength of brittle materials when in the form of thin filaments or plates. The formula relating breaking stress to the cross-sectional area with the strength (P) is no longer valid for small values of the area (S), *i.e.*, $P = F/S$ needs revision. Kvinke has suggested that $P = a + bL/S$ is valid where L is the perimeter of the sample, and a and b are constants. Thus the increase in strength in cylindrical samples is proportional to ratio of perimeter to cross-section. Thus, as the cross-section decreases, the relative effect of surface increases and the Kvinke formula apparently indicates that the increased strength is connected with surface properties. The present work shows that the rupture of brittle materials (glass, quartz, etc.) follows Griffith's theory, *i.e.*, the observed technical strength is determined by the superstresses in the discontinuities. The discontinuities play the part of Griffith's cracks and are distributed throughout the volume of the material, those on the surface being most potent, as being those where breakdown begins. Treatment of the surface by hydrofluoric acid changes the surface discontinuities and increases the strength. The probability of such dangerous discontinuity occurring is treated statistically, the conclusion being that the most probable strength for cylindrical samples will be proportional to their diameter and will be given by the formula $P = a + b/r$. S. G. B.

See also Abstracts 4822, 4825, 5126.

GRAVITATION.

See Abstracts 4868, 4891.

HYDRODYNAMICS AND AERODYNAMICS.

4843. Gliding of a Plate on a Stream of Finite Depth. A. E. Green. *Cambridge Phil. Soc., Proc.* 31. *pp.* 589–603, *Oct.*, 1935.—The two-dimensional gliding of a semi-infinite plate on the surface of a stream of finite depth is examined. The lift L in terms of the ratio D/H, where H is the depth of the stream at infinity up-stream, and D is the height of the trailing edge of the plate above the surface of the stream is calculated. In particular it is found that the trailing edge cannot be at a height of more than $0{\cdot}07H$ approximately, above the up-stream fluid surface. AUTHOR.

4844. Amplitude Distribution and Energy Balance for Small Disturbances of Motion along Plates. H. Schlichting. *Göttingen Nachrichten, Fachgruppe* 1. 1. 4. *pp.* 47–78, 1935.—The stability of laminar motion along a flat plate is investigated. The mean secondary velocities $\sqrt{\overline{u'^2}}$, $\sqrt{\overline{v'^2}}$ and the correlation coefficient $\overline{u'v'}/\sqrt{\overline{u'^2}.\overline{v'^2}}$ are calculated as functions of the wall distance y, for two specially independent disturbances. The balance of energy for the secondary motion is also examined. The requirement that the entire exchange of energy for neutral disturbances should be zero is satisfied to a good approximation and furnishes an acceptable control for the further solution of proper-value problems. G. F. P. T.

4845. General Criterion for the Instability of Laminar Velocity Distribution. W. Tollmien. *Göttingen Nachrichten, Fachgruppe* 1. 1. 5. *pp.* 79–114, 1935.—The stability of the symmetrical velocity profiles in a channel and in the boundary layer is discussed in detail. The effect of friction has usually been supposed to be small, but in this investigation the frictional terms are retained. By using a very general hypothesis for the form of the velocity distribution the result is proved that velocity profiles with a critical point are unstable. This comprehensive result is used to elucidate wave-length, wave velocity and the origination of the considerable disturbances which arise. The theory is then discussed in connection with boundary layer phenomena and the origin of turbulence. G. F. P. T.

4846. Circulation Round a Thin Elliptic Cylinder. L. Howarth. *Cambridge Phil. Soc., Proc.* 31. *pp.* 582–584, Oct., 1935.—In a previous paper [see Abstract 1966 (1935)] a solution was given of the problem of determining the circulation around a thin elliptic cylinder in a steady stream of slightly viscous fluid when the major axis of the cylinder is inclined at a small angle to the direction of flow at infinity. A largely qualitative analysis of the manner in which this circulation is built up is described when the motion of the fluid or cylinder is started instantaneously from rest with a given velocity. G. F. P. T.

4847. Flow Past a Circular Cylinder. L. Howarth. *Cambridge Phil. Soc., Proc.* 31. *pp.* 585–588, *Oct.,* 1935.—Buri's method of solution of the equations of turbulent motion in a boundary layer is applied to the flow past a circular cylinder at high Reynolds numbers. The experimentally measured pressure distribution is used to obtain the velocity distribution at the edge of the boundary layer so that the application of Buri's method can be checked experimentally, but it is not possible to draw any very definite conclusions about the validity of the method.
G. F. P. T.

4848. Ground Water Flow. G. Hamel and E. Günther. *Zeits. f. angew. Math. u. Mechanik,* 15. *pp.* 255–265, *Oct.,* 1935.—Details of the method used for calculating the integral $\int_0^1 \gamma(t)/(t-\lambda).dt$ are given. Numerical values are obtained for the interval $0 \leq \lambda \leq 1$, and for three other intervals. These necessary but laborious calculations are made to supplement previous work on ground water flow [see Abstract 3524 (1934)].
G. F. P. T.

***4849. Self-Regulating Discharge Syphon. G. Mönch.** *Zeits. f. techn. Physik,* 16. 10. *p.* 314, 1935.—A glass syphon is described which regulates the fluid discharge from a condenser which has a continuous supply. As the condenser fills up the discharge quantity increases, with the outflow ejected the fluid level diminishes, whilst the depth of immersion is adjustible ; with restored outflow the syphon is re-filled. G. F. P. T.

***4850. Aspiration by Volumetric Pumps. S. Nikitine.** *Comptes Rendus,* 201. *pp.* 590–592, *Oct.* 7, 1935.—The performance of a volumetric liquid pump increases proportionally to the rate of operation of the pump only when this rate does not exceed a limiting value ; the yield increases only slowly with any subsequent increase of speed of operation and the volumetric efficiency is reduced. An explanation of these facts based on a theory of static cavitation is derived mathematically. J. S. G. T.

4851. Linear Hydraulic Elements and the Resistance of an Immersed Body in Permanent or Transitory Regions. C. Camichel L. Escande, E. Crausse and J. Baubiac. *Comptes Rendus,* 201. *pp.* 533–535, *Sept.* 30, 1935.—The fall of similar bodies through water is studied by using a machine similar to Atwood's. The dimensions of the body and the motor effect are varied. A film or a system of electric contacts allows the laws of motion to be determined so that the resistance can be calculated for permanent and transitory regions. The notion of linear hydraulic elements is verified for a larger field of investigation. [See Abstract 985 (1935).] G. F. P. T.

See also Abstracts 4857, 4898, 5089.

KINETIC THEORY OF MATTER.

See Abstracts 4991, 5088, 5114.

MATHEMATICAL METHODS, THEORY OF MEASUREMENTS, UNITS AND DIMENSIONS.

4852. Table of Inverse Trigonometric Functions in Radians. I. Roman. *Terr. Mag.* 40. *pp.* 307–316, *Sept.*, 1935.

4853. Generalised Theory of Vector Probability. S. Ono. *Tokyo B.D., Sci. Reports, No.* 46. *pp.* 279–303, *Sept.* 30, 1935.—An affine geometry is developed starting from the idea that any two vectors A and B are expressible in terms of a fundamental set of vectors whilst their product AB is defined in a special way. Covariant differentiation and other relations in such a geometry are worked out. G. C. McV.

4854. Connection between Correlation and Contingency. H. O. Hirschfeld. *Cambridge Phil. Soc., Proc.* 31. *pp.* 520–524, *Oct.*, 1935.—A discontinuous bivariate distribution is considered such that N × Q non-negative values p_{vq} ($v = 1, 2, \ldots . N$; $q = 1, 2 \ldots . Q$) are the theoretical probabilities of the vth value of a variate X_μ ($\mu = 1, 2 \ldots . N$) concurring with the qth value of a second variate Y_s ($s = 1, 2 \ldots . Q$). Correlation theory for such a distribution gives much better results, if both regressions are linear, and these regressions are transformed by a change of the variates X_v, Y_q. The original scales or better values assigned to the X_v and Y_q are, however, often chosen in a conventional or artificial way and, if a distribution of characteristics is treated, they are not known at all. The author shows that with a given discontinuous distribution p_{vq} there are at least [max (N, Q)–1] different possibilities of introducing new values for the variates x_v, y_q (instead of the original variates, if there are any) such that both regressions are linear. R. S. R.

4855. Absolute Units and Electrical Measurements. R. T. Glazebrook. *Nature*, 136. *pp.* 667–669, *Oct.* 26, 1935.—An absolute measurement is one in which a quantity is not merely compared with another quantity of the same kind, but is determined by reference to certain fundamental units of another kind treated as postulates. The proportionality constants in the classical electromagnetic equations must obey the relation $A^2/\mu_0 K_0 = C^2$, where μ_0 and K_0 are the constants in the equations for the force between magnet poles and electric charges respectively, A is that in the equation for the force between a current and a magnet pole, and C is the velocity of wave propagation. The M.K.S. system becomes absolute in exactly the same sense as the C.G.S. system has done, if the constants are chosen so as to satisfy this relation. It is urged that space permeability (μ_0) should be regarded as a fourth fundamental quantity in electromagnetic systems, and that its value in the M.K.S. system should be fixed at 10^{-7} (or $4\pi \times 10^{-7}$ for the rationalised system), A being made equal to unity. L. H.

See also Abstracts 4841, 4856, 4864, 4869, 5221.

MECHANICS, CLASSICAL.

4856. Application of Operators to the Dynamics of Continuous Systems. H. Baumann. *Ann d. Physik*, 24. 1. *pp.* 49–83, *Sept.*, 1935.—It is shown how the Heaviside operational calculus can be applied to the motion of the continuous systems whose equations of motion do not involve the time explicitly. G. C. McV.

4857. Critical Conditions of Dynamical Systems and Elastic Structures. W. J. Duncan. *Phil. Mag.* 20. *pp.* 789–793, *Nov.*, 1935.—Attention is drawn to a method for determining the critical conditions of structures which was first given by C. Minelli. Minelli states that the correctness of this method may be regarded as axiomatic, and he supplies no proof. It is now shown that the method only leads to correct results when the forces acting are conservative, a condition which is usually not satisfied in aerodynamical problems. Nevertheless, the method is convenient in application and is valid for a large class of cases. AUTHOR.

See also Abstracts 4834, 4927, 5194.

MECHANICS, QUANTUM.

4858. Physical Basis of the Quantum Theory. Grete Hermann. *Naturwiss.* 23. *pp.* 718–721, *Oct.* 18, 1935.—The physical principles lying at the basis of quantum mechanics are reviewed with particular emphasis on the nature of measurement. The principle of causality, it is claimed, is not contradicted by the quantum theory but, on the contrary, has been clarified and simplified by that theory. G. C. McV.

4859. Quantum Electrodynamics. Part III. Gauge Invariant Quantisation and Dirac Magnet Poles. P. Jordan. *Zeits. f. Physik*, 97. 7–8. *pp.* 535–537, *Oct.* 25, 1935.—In continuation of previous work [see Abstract 4111 (1935)] it is shown that the formulæ previously developed permit an extension of the theory allowing the existence of magnetic single poles of strengths in accordance with Dirac's theory. It is also shown that the electromagnetic field is characterised by a system of gauge-invariant bilinear magnitudes whose transformation rules are independent of the field strength. J. S. G. T.

4860. Two-Centre Problem in Wave Mechanics. W. G. Baber and H. R. Hassé. *Cambridge Phil. Soc., Proc.* 31. *pp.* 564–581, *Oct.*, 1935.—From the two general equations for the two-centre problem, each containing three parameters, p, a numerical multiplier of the distance R between the nuclei, and the separation constant A, the two values of which are denoted by A (λ) and A (μ), a method is deduced for obtaining approximate values of A (μ) for large values of p, this being essential for the investigation of the problem of unequal nuclei. A proof is obtained, also, that Hylleraas' solution of the λ-equation is convergent. The case of equal nuclei is treated mathematically, and, on the above basis, an extension is made to the case of different or unequal nuclei. N. M. B.

4861. Radiative Collision between Fast Charged Particles. C. Møller. *Roy. Soc., Proc.* 152*A*. *pp.* 481–496, *Nov.* 1, 1935.—A correspondence method is developed for the treatment of the radiative collision between two particles. The method is relativistically invariant and forms an immediate generalisation of the method previously used for the treatment of the non-radiative collision. In the limiting case, where one of the particles becomes infinitely heavy, the formula obtained for the differential cross-section goes over into the formula of Bethe and Heitler.

It is shown that the quantum electrodynamics of Heisenberg, Pauli, and Dirac, apart from infinite self-energy terms, gives the same result as the present method. AUTHOR.

4862. Relativistic Self-Consistent Field. B. Swirles. *Roy. Soc., Proc.* 152*A*. *pp*. 625–649, *Nov*. 15, 1935.—A relativistic treatment of a many-electron atom on the lines of the self-consistent field method with " exchange," is developed. Magnetic interactions and retardation effects are, for the present, neglected. Tables are given from which the expression for the total energy of an atom containing s, p, d electrons may be constructed. An example is given of the derivation of the relativistic self-consistent field equations, including " exchange " terms, by means of a variation principle. AUTHOR.

4863. General Statistical Theory and Applications to Chemical Energetics. G. Allard. *Ann. de Physique*, 4. *pp*. 305–376, *Oct*., 1935.—By an extension of Planck's theory a statistical theory embodying the Bose-Einstein and Fermi-Dirac theories is derived, and is applied to mixtures which may or may not be characterised by chemical reaction. The classical results of chemical energetics can now be derived by purely statistical methods. The theory is applied to condensed phases ; a general form of the law of mass action is derived, and monatomic and diatomic molecules characterised by various degrees of motion are discussed. J. S. G. T.

4864. Probability Relations between Separated Systems. E. Schrödinger. *Cambridge Phil. Soc., Proc.* 31. *pp*. 555–563, *Oct*., 1935.—The probability relations that can occur between two separated physical systems are examined mathematically on the assumption that their state is known by a representative in common. The two families of observables, relating to the first and to the second system respectively are linked by at least one " match " between two definite members, one of either family ; " match " denoting that the values of the two observables determine each other uniquely, and can therefore be taken to be equal. In general, there is but one match, but there can be more. If, in addition to the first match, there is a second one between canonical conjugates of the first mates, then there is an infinite number of matches, every function of the first canonical pair matching with the same function of the second canonical pair. Thus there is a complete one-to-one correspondence between those two branches of the two families of observables which relate to the two degrees of freedom in question. If there are no others this correspondence persists as time advances, but the observables of the one system change their mates in the way that the observables of the other system undergo a certain continuous contact-transformation. [See Abstract 2411 (1935).] N. M. B.

4865. Determination of h. G. Schaitberger. *Ann. d. Physik*, 24. 1. *pp*. 84–98, *Sept*., 1935.—The intensity of X-rays of given wave-length, reflected from crystals is measured for different voltages, and the limit of frequency imposed by the relation $h\nu = e\mathrm{V}$ is deduced by interpolation. The value of h so found is $6555 \pm 0{\cdot}002 \times 10^{-27}$, the value of e being taken to be $4{\cdot}770 \times 10^{-10}$. G. C. McV.

See also Abstracts 4895, 5007, 5041, 5162.

RELATIVITY AND ETHER.

4866. Velocity of Light and the Generalised Lorentz Transformations. F. Tavani. *Phil. Mag.* 20. *pp*. 835–840, *Nov*., 1935.—The forms of the equation $\sum_{\gamma=1}^{3} (dx_\gamma/dt)^2 = C^2$ given by the theory of relativity, when the space in which the origin moves has two or three dimensions, in place of one, are derived. When the origin describes a curved path, the original Lorentz transformation does not represent the characteristics of the motion of a point referred to a rotating frame. J. S. G. T.

4867. Isotropic Solution in Relativity. V. V. Narlikar and D. N. Moghe. *Roy. Astron. Soc., M.N.* 95. *pp.* 735–737, 1935. *Supplement.*—The general equation of isotropy for a universe filled with matter, proposed by A. G. Walker, is solved for a particular case. The metric found is :

$$ds^2 = r^2dt^2 - (A + Bt + \tfrac{1}{2}t^2)(dr^2 + r^2\,d\theta^2 + r^2\sin^2\theta\,d\phi^2)$$

so that there is a concentration of matter at the origin of spatial coordinates. The law of recession for the case $A = B = 0$ is $v/r = c/t$, where c is $\pm\sqrt{2}$ or -2. In addition, spiral orbits round the origin are possible.

G. C. McV.

4868. Applications of Whittaker's Extension of Gauss' Theorem in General Relativity. J. T. Combridge. *Phil. Mag.* 20. *pp.* 971–977, *Nov.*, 1935. *Supplement.*—Whittaker's extension of Gauss' theorem in general relativity [see Abstract 1996 (1935)] is applied to three existing solutions of Einstein's equations, *viz.*, (1) Wilson's solution for the field of an infinite rod, (2) Curzon's solution for the field of two particles, and (3) Jeffrey's solution for the field of an electron. J. S. G. T.

4869. Uniqueness Theorem. M. H. L. Pryce. *Cambridge Phil. Soc., Proc.* 31. *pp.* 625–628, *Oct.*, 1935.—The uniqueness of the solutions, under suitable boundary conditions of two closely-related partial differential equations, *viz.*, (1) that satisfied by the potential in the electrostatics of Born's new field theory [see Abstract 1875 (1934)] and (2) that satisfied by a minimal surface in four dimensions, is established. J. S. G. T.

4870. Electromagnetic Field Theory. T. Lewis. *Phil. Mag.* 20. *pp.* 1000–1025, *Nov.*, 1935. *Supplement.*—The significance of the terms *action, mass,* and *electron* in the classical, Lorentz and McLaren theories are referred to, and McLaren's ideas of field theory are developed. It is shown that a pure field theory based on Maxwell's equations and the principle of least action leads to a theory of the electron which is at least as satisfactory as theories based on notions of electric substance and force, *e.g.*, Lorentz's theory. In some respects it is even more satisfactory, *e.g.*, it leads to the correct expression for the rest mass. Whether the theory allows the existence of stable systems of electrons (+ protons) such as atoms has to be investigated, but there appears to be no reason why this should not be the case. Schott's work relating to a rigidly electrified sphere capable of executing periodic orbits without radiating energy [see Abstract 3222 (1933)] is of significance in this connection. J. S. G. T.

4871. Geometrisation of Physics. S. C. Bagchi. *Calcutta Math. Soc., Bull.* 26. *pp.* 39–50, *June*, 1934. *In English.*—It is shown how the field-equations of general relativity and of unified field theories, as well as the generalised equation of the electron in Riemannian space, proposed by Schrödinger, are all the invariants of transformations of appropriately chosen generalised spaces. G. C. McV.

See also Abstracts 4884, 4894, 4895.

SOLUTION.

4872. Solubility of Deuterium and Hydrogen in Palladium. A. Sieverts and G. Zapf. *Zeits. f. phys. Chem.* 174. *Abt.A.* 5. *pp.* 359–364, 1935.—The results of measurements of the solubilities of H_2 and D_2 in solid Pd between 300° and 1100° C. confirm previous results as regards H_2. The ratios of the solubilities for D_2 and H_2 are 0·67 at 300°, 0·91 at 1000° and nearly 1 at higher temperatures. At constant temperatures the solubility in each case is proportional to the square root of the gas pressure. T. H. P.

4873. Mutual Solubility of Heavy Water and Organic Liquids. J. Timmermans and G. Poppe. *Comptes Rendus*, 201. *pp.* 608–610, *Oct.* 7, 1935.—The upper and lower critical solution temperatures of a 33·2 % solution of α-picoline in D_2O to which 1·07 % KCl has been added are 112·5° and 92°, with complete miscibility at 102·5° under 90 kg./cm.^{2}. In a 31·1 % solution in H_2O with the same percentage of KCl the corresponding figures are 128·5 and 87·5° (the centre of which is at 108°). These and similar results with tertiary butyl alcohol indicate that a higher ratio of KCl to the organic liquid is required to produce separation in H_2O than in D_2O, and that the domain of immiscibility in the latter is greater. [See Abstract 4488 (1935).] C. A. S.

4874. Solubility of Barium Iodate in Salt Solutions. G. Macdougall and C. W. Davies. *Chem. Soc., J. pp.* 1416–1419, *Oct.*, 1935.—The solubility of barium iodate monohydrate in a number of aqueous salt solutions at 25° is reported. Corrections for ionic association remove the specific deviations found in dilute solutions, and the results agree with the Debye-Hückel limiting formula. The dissociation constant of the $BaIO_3^{\cdot}$ ion is 0·08, and that of $BaClO_3^{\cdot}$ is approximately 0·2. AUTHORS.

4875. Critical Solution Temperature of Mineral Oils. E. Vellinger and J. D. Herrenschmidt. *Comptes Rendus*, 201. *pp.* 780–782, *Oct.* 28, 1935.—With a mixture of 9 parts of acetone and one of amyl acetate as solvent the critical solution temperature of four oils of different origin (Pennsylvania, Russia, Venezuela and Texas) showed little difference. There was however a marked increase as refinement was carried further (*i.e.*, by use of more H_2SO_4), but while slightly and averagely-refined oils showed no decrease after 25 months use in a transformer, that of super-refined oil decreased rapidly after 10 months use. C. A. S.

See also Abstracts 4781, 4807, 4837, 5081, 5115, 5116, 5173, 5175, 5207.

SURFACE TENSION AND COHESION.

4876. Stationary Capillary Waves. N. A. Slioskine. *Comptes Rendus*, 201. *pp.* 707–709, *Oct.* 21, 1935.—The methods of H. Villat are used to obtain a general mathematical solution of this problem not restricted to infinitely small amplitudes. P. H. B.

4877. Influence of H-Ion Concentration on the Surface Tension of Soap Solutions. J. Powney. *Faraday Soc., Trans.* 31. *pp.* 1510–1521, *Nov.*, 1935.—The surface tensions of solutions of the Na and K salts of oleic, lauric and myristic acids are determined at 20° C., in the presence of atmospheric CO_2. The change of surface tension produced by added alkalies, and by changes of pH in general, are investigated. It is found that small changes of pH can produce very considerable changes of surface tension. The laurates are particularly sensitive in this respect. The influence of CO_2 on the surface tension of soap solutions can be correlated with changes of pH produced by adsorption of CO_2. AUTHOR.

4878. Capillary Structure of Wood. A. J. Stamm. *Physics*, 6. *pp.* 334–342, *Oct.*, 1935.—The equilibrium permeability of soft woods to damp air was studied by means of a differential pressure drop apparatus. The permeability of transverse sections of thickness less than the average fibre length is independent of the equilibrium relative vapour pressure (π). The permeability of thicker sections, which is dependent on the size of the pit openings, increases with decreasing π. The square root of the permeability is proportional to the moisture content of the wood from 0 % to 20 %, but at higher moisture contents the permeability falls off considerably from proportionality, due to the formation of water films across the capillaries which can only be dislodged by considerably increased pressure. A new means of determining the distribution of the size of the openings in a porous membrane is based on these findings. P. H. B.

***4879. Monomolecular Films. Part I. Electrometer Valve Measurements of P.D. at Air-Liquid Contacts. D. G. Dervichian and C. O'Ceallaigh. Part II. Direct Recording of the Electric Effect. D. G. Dervichian.** *J. de Physique et le Radium*, 6. *pp.* 427–432, *Oct.*, 1935.—An electrometer valve circuit is described for the measurement of variations of p.d. at an air-liquid contact, due to monomolecular films. Compensation is made for variations in the thermionic emission of the filament of the valve and for changes in the battery voltage. In Part II Dervichian describes the adaptation of the apparatus for photographic recording, and its use in conjunction with his instrument for direct recording of surface tension [see Abstract 2876 (1935)]. The two measurements are recorded simultaneously on a single photographic plate. Attention has been confined to substances which have been studied by other experimenters. The results are in agreement with the work of Adam and Harding. C. J. B. C.

4880. Monomolecular Films. Part I. Surface Pressures and Potentials of Films of Long Molecules. W. D. Harkins, E. F. Carman and H. E. Ries, Jr. *J. Chem. Phys.* 3. *pp.* 692–698, *Nov.*, 1935.—Film pressures and surface potentials were measured for a series of linear polymers of ω-hydroxy decanoic acid, ranging in molecular weight from 780 to 25,200. The molecules are oriented parallel to the surface. An improved form of the apparatus of Harkins and Fischer was used [see Abstract 361 (1934)]. The chief modification in the procedure was the use of two radioactive Po electrodes over the film. The pressure-area relations show that the area per molecule in the condensed films is nearly proportional to the molecular weight and that the compressibility of the films is large. The film density is found to be lowest for the polymers of smallest molecular weight. The films are not very sensitive to changes in hydrogen-ion concentration, but on changing from an acid to an alkaline substrate the films in the expanded state give higher molecular areas at given pressures, and the pressures for film collapse are considerably higher. Dimensions of the molecules are calculated and a complete table of mean values is included. The vertical cross-section of the molecules varies between 19·4 and 19·9 sq. Å, or is nearly the same as the horizontal cross-section (20·5) of vertically oriented molecules such as stearic acid. Some differences between films with perpendicular orientation to the surface and those with parallel orientation are tabulated. The surface potentials of the polymer films rise to between 400 and 450 mV, although the surface density of the polar groups is only 1/3 to 2/5 that of stearic acid type films, which also give potentials of about 400 mV. The contribution of each polar group is, therefore, considerably greater than that of the dipole of the vertically oriented stearic acid molecule. The surface potential of a condensed film is found to increase about 13 % less rapidly than the surface density of the dipoles. AUTHORS.

4881. Stability of Impinging Drops: Upper Velocity Limit. S. W. Gorbatschew and W. M. Nikiforowa. *Kolloid. Zeits.* 73. *pp.* 14–20, *Oct.*, 1935.—The mechanism of the rebounding and coalescence of drops in mist was investigated by allowing a drop carried on a glass thread at the bottom of a pendulum to collide at varying speeds and angles with a stationary drop placed on paraffin. The diameter of the drop mostly investigated was 1·5 mm. The drops were in contact during $0\cdot1$ to $1\cdot5 \times 10^{-3}$ sec. The greater the angle of approach the greater the maximum spread for coalescence. Capillary-active substances change the limiting speed especially when the angle of approach is large. Reduction in the drop size raises the limiting speed. Additional information was obtained by using the drop as a microgalvanic element. [See following Abstract.] P. H. B.

4882. Stability of Impinging Drops: Lower Velocity Limit. S. W. Gorbatschew and E. R. Mustel. *Kolloid Zeits.* 73. *pp.* 20–24, *Oct.*, 1935.—The behaviour of the droplets of water jets impinging at almost zero angle was studied photographically. No definite value for the minimum velocity at which the drops cease to repel each other was found, but for drops of 1 mm. dia. coalescence occurs in 50 % of contacts when there is a relative velocity of about 6·4 cm. per sec. It is provisionally stated that surface active substances do not affect the limiting velocity. [See preceding Abstract.] P. H. B.

See also Abstracts 5211, 5212.

TIME (STANDARDS, MEASUREMENTS, APPARATUS).

***4883. Pocket Watches. Part I. Limitations of Performance. W. Keil and K. Hild.** *Phys. Zeits.* 36. *pp.* 685–693, *Nov.* 1, 1935.—Good pocket watches of serial production were studied when in use in order to gain information as to the effect of conditions on their performance. Both long- and short-period fluctuations in the rate must be taken into account when estimating the performance. The short period fluctuations are greatly affected by the initial condition of the mechanism. The effect of shocks was found to be slight. Temperature changes produced large but unpredictable changes in the rate. P. H. B.

4884. Evolution of the Notion of Time. G. Windred. *Am. J. Sci.* 30. *pp.* 383–391, *Oct.*, 1935.—A sketch is given of the ideas of time found in mathematical physics from the time of Newton to the present day. G. C. McV.

VACUA, HIGH.

***4885. Oil Diffusion Pumps for Evacuating X-Ray Tubes. J. A. Bearden.** *Rev. Sci. Instruments*, 6. *pp.* 276–277, *Sept.*, 1935.—A description is given of a simple glass pump embodying an improved method of heating the oil (Apiezon B). It is pointed out that, in an X-ray tube residual oil vapour is decomposed, presumably by bombardment, and gives rise to a serious deposit of carbon on the anode, while the kathode filament is attacked by the oxygen liberated. Neither long connecting tubes nor baffles eliminated the trouble, which was, however, overcome by the use of a liquid-air trap. A trap cooled by CO_2, ice and methyl alcohol was less satisfactory. G. E. B.

***4886. Use of McLeod Gauge. M. Francis.** *Faraday Soc., Trans.* 31. *pp.* 1325–1331, *Sept.*, 1935.—Discusses the application of the McLeod gauge to the measurement of the pressures of non-condensible gases. It is shown that departures from Boyle's law are not sufficient to account for errors. The disappearance of gas by sorption is shown to take place mainly in the bulb, and that agreement of readings on various ranges is not proof of the absence of sorption errors. Tests made using SO_2 failed to reveal measurable discrepancy down to a few thousandths of 1 mm. of Hg. G. E. B.

VISCOSITY, FRICTION AND LUBRICATION.

4887. Viscosities of Liquid Methane and Ethylene. N. S. Rudenko and L. W. Schubnikow. *Phys. Zeits. d. Sowjetunion*, 8. 2. *pp.* 179–184, 1935. *In German.*—A method previously used for the determination of the viscosities of liquid N_2, O_2, A, and CO [see Abstract 617 (1935)] is now applied to liquid CH_4, and liquid C_2H_4. The results for the six liquids are shown graphically. The viscosity of CH_4 varies from 0·00210 to 0·00098 c.g.s. units, over the temperature range 90° K. to 111° K., whilst that of C_2H_4 varies from 0·00522 to 0·00178 over the range 110° K. to 169° K. R. W. P.

4888. Viscosity and Constitution of Organic Fluids. S. Papkov. *Zeits. f. phys. Chem.* 174. *Abt.A.* 6. *pp.* 445–448, 1935.—A new formula for viscosity is proposed, namely, $S = (M/d_t)\sqrt[3]{\eta_t}$, with which it is possible, by the addition of the atomic increments, to calculate the viscosity of organic liquids. The validity of the equation is shown by calculating the S-value for 26 liquids. The degree of association has been calculated for strongly associated liquids and the values obtained compared with those found by other authors (MacLeod, Bingham). J. K.

4889. Conception of a Complex Viscosity and its Application to Dielectrics. A. Gemant. *Faraday Soc., Trans.* 31. *pp.* 1582–1590, *Nov.*, 1935.—A theory of complex viscosity is put forward and applied to the case of dielectric losses due to dipole rotation. The results are found to be in qualitative agreement with observations on glass and paraffin, etc. F. J. B.

See also Abstracts 4781, 4791, 4836.

ASTRONOMY AND ASTROPHYSICS.

ASTRONOMICAL APPARATUS AND OBSERVATORY EQUIPMENT.

See Abstract 4993.

COMETS AND METEORS.

4890. Problems Presented by Recent American Fireballs. C. P. Olivier. *Am. Phil. Soc., Proc.* 75. 6. *pp.* 483–498, 1935.—Of 33 recent fireballs (of some 1000 reported) for which there are sufficient details, the average height of appearance was 140, of disappearance 36 km. (of 11 $<$ 20), velocity (of 4) 128–236 km./hr. The largest, that of March 24, 1933, at 6.5 a.m., over Oklahoma and Texas, appeared at a height of 141·2 and disappeared at 16·6 km., length of path 670·3 km. It was accompanied by loud sounds 100 km. each side of 300 km. of the path. It was bluish-white becoming redder, and appeared to be spinning rapidly. Numerous drawings and photographs were obtained. It appeared to be some 20′ in dia., and left a train in places 7–8 km. wide and visible for 1·5 hr., the luminosity apparently due to a mixture of gas (producing phosphorescence) and fine dust with probably some electrical affect [see Abstract 2011 (1907)]. It was probably at first one stone, gradually disintegrating, as there appeared to be several explosions. Some fragments were recovered. C. A. S.

COSMOGONY.

4891. Gravitation in Cosmological Theory. G. C. McVittie. *Zeits. f. Astrophysik,* 10. *pp.* 382–390, *Oct.* 18, 1935. *In English.*—The suggestion is put forward that the term " gravitational acceleration " in cosmological theory should be applied only to accelerations possessing properties similar to those of the gravitational acceleration of Newtonian theory. In the teleparallel theory of the expanding universe, accelerations arise if the metric of space-time is not Euclidean or conformal to a Euclidean metric. It is shown that the state of the fluid filling the universe does not, as in general relativity, completely determine the metric nor are the accelerations found for free particles necessarily gravitational. To fix the metric and, at the same time, to make the accelerations gravitational a " law of gravitation " is required which should be consistent with the Newtonian law. Thus although the teleparallel theory abandons the principle of equivalence and the field-equations of general relativity, yet gravitational phenomena are still represented by the coefficients of the metric of space-time. G. C. McV.

4892. Kinematics and World-Structure. H. P. Robertson. *Astrophys. J.* 82. *pp.* 284–301, *Nov.,* 1935.—The idealised cosmological problem, in which the nebulæ are considered as particles in homogeneous flow, is analysed from the standpoint of the operational methodology, allowing the fundamental observers the use only of clocks, theodolites, and light-signals. It is found, as an extension of the Helmholtz-Lie solution of the problem of physical space, that such a space-time necessarily admits the introduction of an invariant Riemannian metric of precisely the form and generality of that on which the general relativistic theory of cosmology is based, and in terms of which all given elements can be interpreted in the same way as in the relativistic theory. AUTHOR.

4893. Two Methods of Investigating the Nature of the Nebular Red-Shift. E. Hubble and R. C. Tolman. *Mt. Wilson Observat. Contrib. No.* 527. *Astrophys. J.* 82. *pp.* 302–337, *Nov.*, 1935.—The nature of the red-shift can be investigated by considering either the relation connecting nebular dimensions with observed luminosities or that connecting nebular counts and observed luminosities. These relations are found theoretically firstly, on the basis of the expanding universes of relativistic cosmology in which the red-shift is due to recession and, secondly, on the basis that the red-shift is due to a reduction of the wave-length of light-waves moving in a static Einstein universe, the cause of the reduction being unknown. A discussion of the present state of the observational material leads to the conclusion that the relation between nebular dimensions and luminosities cannot be used to discriminate between the two theories considered for the red-shift. The relation between counts and luminosities, however, agrees with the hypothesis of wave-length reduction in a static universe. It is also in agreement with the relation found from relativistic recession, provided the model of the universe used has a rather large positive spatial curvature. These conclusions as to the theoretical nature of the red-shift are expressed with reserve owing to the difficulties inherent in the observations. G. C. McV.

4894. World-Trajectories in Milne's Theory. V. V. Narlikar. *Phil. Mag.* 20. *pp.* 1062–1067, *Nov.*, 1935. *Supplement.*—The accelerated particles in Milne's kinematical relativity [see Abstract 1347 (1933)] are assumed to have mass which varies with velocity as in special relativity. It is then shown that Milne's invariant ξ, is the square of the ratio of the momentum of the particle, relative to the observer at the origin, to its invariant momentum, m_0c, where m_0 is the rest-mass of the particle. The relative momentum is shown to become infinite in a finite time and at a finite distance from the observer at the origin. The integrals of the equations of motion of the accelerated particles are also shown to give rise to an equation yielding the analogues of Newton's first and second laws of motion. The curvature of the trajectory of an accelerated particle is evaluated and the trajectory is proved to lie in a plane through the origin. G. C. McV.

4895. Pressure of a Degenerate Electron Gas and Related Problems. A. S. Eddington. *Roy. Soc., Proc.* 152*A*. *pp.* 253–272, *Nov.* 1, 1935.—It is assumed that the ψ-waves representing an assemblage of particles contained in an arbitrary rectangular block of degenerate gas should be standing waves analysable into Fourier components in terms of fixed coordinates in the block. It is also assumed that the operator representing the energy tensor is $-\frac{1}{m}\frac{\delta^2}{\delta x_\mu\,\delta x_\nu}$ where x_μ are coordinates and m is an invariant. These assumptions lead to the equation of state $P \propto p^{5/3}$ for the degenerate gas. If the density of matter in a static Einstein universe is expressed, firstly, as curvature, secondly, as probability distribution of standing ψ-waves, it is possible to obtain a relation between the gravitational and cosmical constants on the one hand and the constants of atomic physics on the other. These relations are found. G. C. McV.

NEBULÆ.

4896. Diffuse Nebulæ in Orion. K. Graff. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 5–6. *pp.* 373–378, 1935.—In Majorca in the winter of 1932–1933, a large nebulous field was discovered extending over the eastern side of Orion. The spaces of dark sky contained within this and neighbouring diffuse nebulæ were examined in 1934, and interesting facts are noted regarding them. They are markedly empty of B-type stars. M. A. E.

4897. Visibility of Pleiades Nebula and Nebula NGC 2237. K. Graff. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 5–6. *pp*. 379–382, 1935.—It is known that some streaks of the Pleiades nebula were observed visually by Tempel in 1859, but eye observation has been neglected since the invention of photography. In the clear air of Majorca the inner Pleiades nebulosity can be seen and its brightness measured by the naked eye, for though the stars involved in it are clearly distinguished at low altitudes, they are lost as the group rises higher in the increasing brightness of its whole area. The nebula in Monoceros, N.G.C. 2237, is also clearly seen here, with slight optical aid, and drawings have been made which show its form and the relative brightness of its parts. M. A. E.

PLANETS.

4898. Theorem of Minimum Loss of Energy Due to Viscosity in Steady Motion and the Origin of the Planetary System from a Rotating Gaseous Disc. H. P. Berlage, Jr. *K. Akad. Amsterdam, Proc.* 38. 8. *pp*. 857–863, 1935.—The theorem of minimum loss of energy in the steady motion of a viscous fluid is applied to the determination of the march of density in a rotating disc of gas which is chemically homogeneous and obeys the law $RT = \text{constant}$. The density is found to fall off from the centre of the disc as $e^{-a\sqrt{r}}$ (a is a constant and r the distance from the centre). Applied to the theory of the formation of the planetary system from a rotating gaseous disc, this density-law leads to masses for the planets which bear some resemblance to those observed. G. C. McV.

STARS.

4899. Influence of Bright Bands in Spectra on the Photographic Magnitudes of Stars. B. Vorontsov-Velyaminov. *Zeits. f. Astrophysik*, 10. *pp*. 353–365, *Oct*. 18, 1935. *In English*.—The measured photographic brightness of hot stars possessing bright bands in spectra includes both the radiation of the continuous spectrum and the emission of bright bands. The latter representing the extreme u.v. radiation of the star transformed into visible frequencies does not characterise the photographic radiation properties of the star proper. Any analysis of stars' diameters, etc., as well as of the variability of luminosity must take into account this " bright bands effect." It is shown theoretically as well as on the basis of observational data that the effect of bright bands may amount to many decimals of stellar magnitude and even to several magnitudes. AUTHOR.

4900. Preferential Motion and Mean Parallaxes. A. Fletcher and A. Mulligan. *Roy. Astron. Soc., M.N.* 95. *pp*. 737–741, *Oct*., 1935. *Supplement*.—The paper is entirely mathematical and deals with the evaluation of an integral, which occurred in a previous communication [see Abstract 4181 (1932)], in terms of elliptic integrals. The result shows that certain approximations previously adopted were valid. G. C. McV.

4901. F-Type Spectra. J. A. Hynek. *Astrophys. J.* 82. *pp*. 338–367, *Nov*., 1935.—A quantitative investigation has been made of the standards of absolute magnitude and of classification now used for stars Fo to Go. It is based on 440 spectrograms of 201 stars. Early F stars differ greatly in width of lines, owing to differences in speed of axial rotation, but the number of "diffuse-line" stars decreases rapidly with advancing spectral type, and none has been found in F8 or Go. The range in absolute magnitude is much smaller than with "sharp-line" stars. The ratio of K to Hδ, which is used in classifying subdivisions of type, has been examined: K increases in intensity about 50 % from Fo to Go, while Hδ decreases 75 %. A detailed examination of the luminosity criteria is also made, and a difference in behaviour is noted between giants and dwarfs, for which an explanation is suggested based on differences of pressure and extent in the atmospheres. M. A. E.

4902. Coefficient of Continuous Absorption. R. v.d. R. Woolley. *Observatory*, 58. *pp.* 297–300, *Oct.*, 1935.—The theory of continuous optical absorption in stellar photospheres is generally based on the formula of Kramers, which is derived from a hydrogen-type model atom. The formula appears in two forms, for light scattered by a neutral atom in becoming ionised (Biermann) and for assemblies (Chandrasekhar). It is now possible by the sum rule to find oscillator strengths directly and thence an absorption coefficient. The Na principal series is compared with H Lyman series, and cannot be represented by a Kramers formula. T. L. M.

4903. Light Estimates of Nova Herculis, December, 1934, to April, 1935. K. Graff. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 5–6. *pp.* 357–368, 1935.—All the magnitude variations of this star observed and measured in Majorca, both with wedge photometer and by eye, are here reduced to a standard scale, allowances being made for Purkinje effect and differences of altitude. From December 25th the light-curve was complicated by minor fluctuations superposed upon it. M. A. E.

4904. Colour Estimates of Nova Herculis, December, 1934; to April, 1935. K. Graff. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 5–6. *pp.* 369–372, 1935.—The colour changes in this star were unusual, for in spite of great variations in the spectrum during the early months, it remained white or yellowish white. The light and colour curves are compared in a diagram: they are approximately parallel, but with a lag in the phase of the former of about 1½ day. This is a characteristic of Cepheids, and implies pulsation, but the pulsations in this case must be very complicated. M. A. E.

4905. Colour Temperature of Nova Herculis, 1934. F. Beileke and O. Hachenberg. *Zeits. f. Astrophysik*, 10. *pp.* 366–376, *Oct.* 18, 1935.—The temperature of this star has been measured with the spectrophotometer. It increased slowly, with fluctuations, during the time of observation, and the mean was 11,300°. The temperature and light curves are parallel, light maxima corresponding with temperature minima. From these data the radius of the star's photosphere was calculated for certain points in the light curve. M. A. E.

4906. Spectrum of Nova Herculis. H. Oehler. *Zeits. f. Astrophysik*, 10. *pp.* 323–338, *Oct.* 18, 1935.—Two spectra of this star were obtained on 1935, January 10th and March 12th, in the region λ6300 to λ3800, with the slitless one-prism spectrograph of Leipzig University Observatory. The most striking feature in the early spectrum is the lines of the Balmer series and the spark lines of several metals; but in the later it is the bright bands of He I, C I, O I, N II, and O II. The intensity of the emission increased markedly between January and March. M. A. E.

4907. New Periods for Variable Stars in the Small Magellanic Cloud. Dorrit Hoffleit. *Harvard Coll. Obs., Bull. No.* 900. *pp.* 3–9. *Sept.* 1, 1935.—Since the brighter portion of the period-luminosity curve for this Cloud depends on comparatively few points, it was thought advisable to obtain additional data for the brighter variables. These are here catalogued and discussed, and there appears to be as yet no reason for altering the shape of the curve for periods over three days. M. A. E.

4908. Asymmetry of Light Curves of Eclipsing Variables Attributable to Tidal Lag. J. Ellsworth. *Comptes Rendus,* 201. *pp.* 540–542, *Sept.* 30, 1935.—The light curves of the eclipsing variables TV and RZ Cassiopeiæ are investigated and the tidal lags are calculated. In the former case the minimum apparent surface occurs during the eclipse corresponding to a tidal lag of about 10°. The minimum brightness is strongly retarded with respect to the largest eclipsed surface thus producing a very unsymmetrical light curve. In the latter case the minimum apparent surface takes place after the eclipse necessitating a tidal lag of over 30° ; the retardation of the minimum is negligible. The resultant asymmetry is too small to be observed. In the case of TV Cassiopeiæ an asymmetrical light curve agreeing well with observation is calculated theoretically on the assumption of elliptic orbits for the variables. J. E. K.

4909. Long-Period Variables. A. D. Thackeray. *Observatory,* 58. *pp.* 285–296, *Oct.,* 1935.—These have mean periods between 200 and 450 days with visual magnitudes ranging from 4 to 6 ; the light curve being like the Cepheids in general form. All stars grow redder towards minimum. Deriving diameters from effective temperature and absolute magnitude, 6 variables show a change of 18% of the whole diameter, providing a "radiometric" radial velocity curve, like the spectroscopic in amplitude but opposite in phase, and this also holds good for Cepheids similarly treated. Long period variables are among the coolest stars known, but with large diameter and mass, and small surface gravity. They have little galactic concentration. They are characterised by H emission near maximum, and the maximum difference between absorption and emission velocities indicate a stellar radius = 200 solar radii as a minimum. Spectroscopic evidence indicates their variates in terms of a single-star pulsation due to some inherent instability. Merrill's "Veil Theory" is discussed and would seem to account qualitatively for the light's variations. A. S. D. M.

4910. Increased Accuracy in Recent Reductions for the Astrographic Catalogue. A. Bemporad. *Accad. Lincei, Atti,* 22. *pp.* 93–96, *Aug.,* 1935.—A new determination has been made of 25 Catania plates of the Astrographic Catalogue, using a larger number of standard stars, later and better values of positions and proper motions derived from Yale observations, and an improved macromicrometer by Cooke. The results show a mean error only 0·6 of the former. M. A. E.

See also Abstract 4921.

SUN.

4911. Profile of Calcium Line λ 4227 in the Solar Spectrum. R. O. Redman. *Roy. Astron. Soc., M.N.* 95. *pp.* 742–760, *Oct.,* 1935. *Supplement.*—The profile of λ 4227 in light taken from the centre of the sun's disc has been determined with a prism spectrograph of high dispersion, fed through a monochromator. The measured central intensity is 4·8% of the adjacent continuous spectrum ; it is 7·9 % when the same instrument is used without the monochromator, the difference being due to scattered light within the spectrograph. The instrumental profile given by the spectrograph has been measured. The correction for finite resolving power derived from this profile reduced the central intensity of λ 4227 to 2 %. AUTHOR.

4912. Profile of Hydrogen Lines and Ultra-Violet Radiation of the Sun. E. K. Kharadse. *Zeits. f. Astrophysik,* 10. *pp.* 339–343, *Oct.* 18, 1935.—The method of investigation of profile widths of H lines of the solar spectrum is applied to an examination of the variation of the sun's ultra-violet radiation. The microphotometer intensity measurements are made on spectrograms of the centre of the sun's disc. The profiles of the Hγ, Hδ and the metal lines Fe 4405, 4072 and K 4227 are measured the latter three being for control purposes only. Although a connection between the widths of the H lines and the ultra-violet radiation is not definitely established, profile variations found in the year 1929 are considered to be real and dependent on the solar activity which reached a maximum at that time. J. E. K.

4913. Intensities of Sodium Lines in the Solar Spectrum. G. Righini. *Zeits. f. Astrophysik,* 10. *pp.* 344–352, *Oct.* 18, 1935.—The equivalent widths and theoretical oscillator strengths are determined for all 22 Na lines observed in the solar spectrum. The equivalent widths plotted as a function of Nf, the number of effective resonators give the well-known curve of growth agreeing with, but having a three times greater damping constant than, the classical theory curve. The quantum theoretical damping is calculated for several transitions and compared with observation. The order of magnitude of the transition probability of two lines corresponding to forbidden transitions is determined. J. E. K.

See also Abstract 4998.

ZODIACAL LIGHT AND GEGENSCHEIN.

4914. Spectrophotometric Comparison of Zodiacal Light and Light of Night Sky. J. Cabannes and J. Dufay. *Comptes Rendus,* 201. *pp.* 696–699, *Oct.* 21, 1935.—The zodiacal light when examined shows in addition to a continuous spectrum the green auroral line and the bands characteristic of the night sky. To test whether the whole effect is due to the zodiacal light simultaneous observations were carried out by the authors in Europe and by Eropkin and Kozirev in Asia. The latter conclude that the green ray is not emitted by the zodiacal light but are unable to settle the question about the bands in the blue. The spectrograph used by the authors in their observations was the same as that used in previous work [see Abstract 2482 (1935)]. The method of interpreting the results obtained is indicated. These results show that the ratio of the intensity of the continuous spectrum of the zodiacal light to the similar spectrum of the night sky is about 1·9, but the corresponding ratio for the green ray is only 1·07. The measurements relating to the bands in the blue indicate also a ratio in the neighbourhood of 1. From this the authors conclude that the zodiacal light emits neither the ray 5577 nor the bands 4838 and 4425 Å, nor any of the radiations which characterise the upper layers of the atmosphere, but gives only a continuous spectrum crossed by Fraunhofer lines. A. E. M. G.

GEOPHYSICS.

GEOPHYSICS, APPLIED.

4915. Electrical Coring Technique. A. Belluigi. *Com. Geod. e Geofis., Boll.* 5. *pp.* 180–189, *July*, 1935.—The author discusses the need for refinement and precision in the technique of electrical coring, *i.e.*, in electrical resistivity measurements according to Schlumberger's method in uncased drill-holes. Owing to the presence of spontaneous polarisation and other parasitic currents, the apparatus must be capable of minimising these disturbing effects. The author describes a suitable outfit for the work, and gives details of the batteries, variable resistances, etc., required, with diagrams of the circuits and connections. E. L. J.

4916. Electrical-Resistivity Prospecting with Two Electrodes. G. Petrucci. *Com. Geod. e Geofis., Boll.* 5. *pp.* 190–203, *July*, 1935.—Although the measurement of electrical resistivities by means of a single pair of electrodes, through which a.c. is fed into the ground, has long been abandoned in geophysical prospecting, the writer considers that this method has useful applications. He describes a series of experiments, in which an earth-box model is employed, having layers of earth of varying salinity and humidity to provide layers representing strata of differing electrical characteristics at various depths. The measurements tend to show that the curve of measured resistivity against distance of separation of the electrodes displays characteristic bends and inflexions, according to the penetration of the current into the successive layers. A special feature is the absence of screening effect in the case of a shallow, good-conducting layer lying above other, deeper, similarly good-conducting layers. A simple relation is shown to exist between the registered points of inflexion and bending on the resistivity-electrode separation curve, and the depths of the more or less conducting layers. The cases studied include some concerning several similar succeeding layers, separated by layers of much greater, or less, resistivity. E. L. J.

HYDROSPHERE, PHYSICS OF THE.

***4917. Penetration of Radiation in Austrian Lakes. O. Eckel.** *Akad. Wiss. Wien, Ber.* 144. 2*a*. 3–4. *pp.* 85–109, 1935.—Measurements of the radiation intensity of filtered and unfiltered light from the sun and sky were made at depths from 1 to 50 m. for eight Austrian lakes on days with little or no cloud. The apparatus is fully described and the sources of error are discussed. In tables the radiation intensity is expressed as a percentage of that at 5 m. for different depths and spectral regions. The change of temperature with depth was also measured but this depends upon the surroundings of the lake, exposure to wind and current flow. The transmission coefficient was found to increase with increase of solar height and increase of depth. The radiation intensity for different wave-lengths is expressed as a percentage of the unfiltered intensity and tabulated for depths of 1, 5, 10 and 15 m. for the several lakes. The variations for different colours are discussed. Finally the results are compared with those of Birge and Juday and of Shelford and Gail. R. S. R.

***4918. Density of Water from Depths of Lake Baïcal. J. Mendelejev.** *Comptes Rendus* (*Doklady*) *de l'Acad. des Sciences, U.S.S.R.* 3. 3. *pp.* 105–108, 1935. *In French.*—The density of water taken at various depths down to 1650 m. in Lake Baïcal was determined by means of a special instrument, consisting of a totally-immersed hydrometer fitted with a fine chain and claimed to give an accuracy of 1×10^{-7} gm./ml. Water distilled from that drawn from the surface had the same density as that from the inflowing river and rain water from the roof. There was an increase of density with depth which reached a minor peak, 29×10^{-7} gm./ml., at 1000 m. (this is thought to be due to conditions connected with the renewal of water in the lake), and a maximum of 56×10^{-7} gm./ml. at 1650 m. The undistilled water increased in density from $1 + 67 \times 10^{-7}$ gm./ml. at 4° C. at the surface, to $1 + 83 \times 10^{-7}$ gm./ml. at 4° C. at 1600 m. It is held that the heavy water of Lake Baïcal is not the same as that obtained by Lewis by electrolysis. P. H. B.

See also Abstract 4937.

LAND, PHYSICS OF THE.

4919. Emission of Radon from Soil. P. R. Zeilinger. *Terr. Mag.* 40. *pp.* 281–293, *Sept.*, 1935. *In German.*—The average of 150 determinations of the amount of radon emitted from the soil during the period Dec., 1933, to Oct., 1934, by Zupancic's method slightly improved [see Abstract 2402 (1934)] in a meadow at Hötting (Innsbruck) was $43 \cdot 5 \times 10^{-18}$ curie/cm.^{2}/sec. The variations with time, position and meteorological conditions were substantially the same as previously found: less from turf-covered than from bare soil; maximum (diurnal) shortly before midday, (annual) in July–August, increase with thawing, or large variations in temperature, and decrease with wind. [See Abstract 2340 (1933).] C. A. S.

See also Abstract 4848.

METEOROLOGY.

4920. Atmospheric Ozone. Estimation by Spectrographic and Chemical Methods. A. Dauvillier. *Comptes Rendus*, 201. *pp.* 679–680, *Oct.* 14, 1935.—68 measurements by each method were made at Abisko between Dec. 22nd and Mar. 7th, the spectrographic method giving results over a few minutes and the chemical method a mean result over the 24 hours. The mean, maximum and minimum percentage contents by weight found for O_3 in the air were (1) spectrographic method 4·1, 6·4 and 1·5, and (2) chemical method 3·3, 6·6 and 1·0 respectively. Compared with Scoresby Sund, the values at Abisko are more constant and relatively feeble towards the end of the polar night. Abisko is less in the zone of maximum auroral activity and it is considered that the differences show that local meteorological conditions are of prime importance for the O_3 content in the air. R. S. R.

4921. Thickness of Atmospheric Ozone during the Polar Winter. D. Barbier, D. Chalonge and E. Vassy. *Comptes Rendus*, 201. *pp.* 787–789, *Oct.* 28, 1935.—Determinations of the ozone content were carried out from Dec., 1934, to March, 1935, at Abisko by observation of stellar spectra [see Abstract 2025 (1935)]. The results found are given in tabular form. An effort is made to determine whether any relation exists between the thickness of the ozone and the origin of the air, use being made of synoptic charts. In warm sub-polar air the ozone content is small, while in Arctic air the content is high. Cold sub-polar air is found to be less rich than Arctic air. The authors, while not claiming to be able to arrive at definite conclusions, consider that the observations (1) give an indication of the origin and the movements of the stratospheric layers and (2) raise the problem of the origin of the ozone, as the air most rich in ozone comes from regions north of the auroral zone; and so they regard it as difficult to attribute the cause to auroral electrons alone. A. E. M. G.

4922. Helium Content of the Stratosphere. F. A. Paneth and E. Glückauf. *Nature*, 136. *pp*. 717–718 *and p*. 723, *Nov*. 2, 1935.—In order to find out at what height of the atmosphere large-scale mixing (winds) ceases to occur, the percentage of helium in samples of air has been obtained by means of sounding balloons sent up from Kew. Up to a height of 18 km. the percentage remains practically constant, but at 21 km. a noticeable increase (8 %) was observed. The co-operation of stratosphere investigators in various parts of the world is invited in order to obtain small samples of air from high altitudes.

See also Abstracts 4914, 4950.

SEISMOLOGY.

4923. Damping of Seismic Vibrations in Surface Layer of Varying Density or Elasticity. K. Sezawa and K. Kanai. *Tokyo Univ. Earthquake Research Inst., Bull.* 13. *pp*. 484–495, *Sept*., 1935. *In English*.—The case of distortional waves transmitted vertically through a surface layer (rigidity μ', density ρ') over a subjacent medium (rigidity μ, density ρ), dissipation into which of the vibrational energy is the main cause of damping, is first considered generally, and the free vibration shown to be damped exponentially. Special cases where μ' increases or decreases linearly downwards, and where μ, ρ and μ', ρ' differ relatively in various ways are next dealt with, and lastly an approximate solution of the problem by use of integral equations is given. [See Abstract 4183 (1935).] C. A. S.

4924. Elastic Wave Due to Potential Energy of Initial Strain. H. Kawasumi and R. Yosiyama. *Tokyo Univ. Earthquake Research Inst., Bull.* 13. *pp*. 496–503, *Sept*., 1935. *In English*.—The case is considered where the strain—a centre of compression or dilatation—suddenly disappears or is suddenly generated; the nature of the waves produced is determined, and the potential energy stored in the strained medium is shown to be sufficient to account for the energy of these waves. C. A. S.

4925. Microseismic Earth Movements Due to Surface Force. K. Iida. *Tokyo Univ. Earthquake Research Inst., Bull.* 13. *pp*. 504–518, *Sept*., 1935. *In English*.—The movements dealt with are the continual minute tremors of the earth's surface unconnected with any earthquake [see Abstract 3628 (1932)]. For purposes of calculation they (regarded as stationary waves caused, *e.g.*, by the wind) are treated as shear vibrations in one or two upper layers of the earth's crust of varying thickness, h ($\ngtr$ 1 km.), density, ρ, and rigidity, μ, underlain by a layer of infinite rigidity. The periods and amplitudes of free and (for two layers) forced vibrations are calculated and figured for various values of h, ρ and μ. Actually recorded tremors are shown to be consistent with two layers, the upper a few hundred m., the lower 1 km. thick, with reasonable values of ρ and μ. C. A. S.

4926. Effect of Discontinuity Surfaces on the Propagation of Elastic Waves. Parts VI and VII. G. Nishimura and K. Kanai. *Tokyo Univ. Earthquake Research Inst., Bull.* **13.** *pp.* **519–554,** *Sept.,* **1935.** *English Abstract.*—In Part VI the nature of the free waves propagated in a surface layer and an adjacent semi-infinite elastic body when a dilatational wave of harmonic-wave type of infinite extent is incident obliquely on the common boundary of the two solids is discussed. It is assumed that the surface layer and adjacent solid can slide over each other at the common boundary for this oblique wave. Next the general properties of vibratory motions of the surface layer and the adjacent medium are discussed when a dilatational wave of shock-wave type is incident obliquely on the common boundary. Diagrams are given for certain numerical waves. In Part VII the same two problems are considered for the two layers when they adhere closely. [See Abstract 205 (1935).] R. S. R.

4927. Steady Forced Vibrations of Single Mass Systems with Symmetrical and Unsymmetrical Non-Linear Restoring Elements. L. S. Jacobsen and H. J. Jespersen. *Frank. Inst., J.* 220. *pp.* 467–496, *Oct.,* 1935.—For the general idealised problem particular solutions are sought for the differential equation $m\ddot{x} + f(x - x_0) = 0$ in which x_0 is a known function of the time. It is assumed that frictional effects are present and that x_0, the instantaneous ground displacement is given by $x_0 = c \sin \omega t$. The theoretical part of the paper is expanded from, and all the experiments are contained in, an addendum to an earlier paper [see Abstract 5170 (1933)]. Although it is not considered that this seismic problem has been solved it is suggested that the initial step towards a solution has been made and that subsequent steps, on account of the inherent complexity of the problem, practically resolve themselves into experiments with models satisfying the conditions for dynamic similitude. This further work is in progress. R. S. R.

4928. Earthquakes Associated with 1934 Eruption of Kilauea, Hawaii. A. E. Jones. *Washington Acad. Sci., J.* 25. *pp.* 429–435, *Oct.* 15, 1935.—Full details of 70 shocks that occurred during 1934, calculated by Isikawa's method, are given, of which only three reached " moderate " intensity. The epicentres of 1/7th of these were under the sea, and of all but about 1/5th around Kilauea or (to a less extent) Mauna Loa. Activity, as indicated by the seismicity index, attributable to the Mauna Loa (Mokuaweoweo) eruption of 1933 decreased, that to that of Kilauea increased, but not in such a way as to have given any recognisable warning of the eruption (of Sept. 6, 1934) ; nor were the observations of tilt in the neighbourhood apparently more helpful in this respect. [See Abstract 4947 (1934).] C. A. S.

TERRESTRIAL ELECTRICITY AND MAGNETISM.

4929. Origin of the Space Charge in the Atmosphere. W. W. Hansen. *Terr. Mag.* 40. *pp.* 277–279, *Sept.,* **1935.**—Reference is made to Whipple's calculations of the space-charge near the ground [see Abstract 159 (1933)] which was found to depend upon the diffusion constant. The author considers the space-charge exists at the ground because the field carries away the negative ions whether diffusion is present or not. He develops this view on qualitative lines and shows it is obtained if the conductivity changes along the lines of force of the field. He concludes that a steady space-charge arises only when the conductivity of the atmosphere is not constant while on the other hand if the conductivity were constant no amount of turbulence could produce a space charge. R. S. R.

4930. Annual and Diurnal Variation of Ions in an Urban Community. A. P. Gagge and I. M. Moriyama. *Terr. Mag.* 40. *pp.* 295–306, *Sept.*, 1935.—At Newhaven, Connecticut, a counter of the Zeleny type is used to measure the diurnal and annual variation in the ion-content of the atmosphere. The ions are placed in groups: small, medium, and large and the limits of mobility measured are 0·07 and 0·0006 cm. per sec./volts per cm. There is a rise in the number of positive small ions during the summer, but the negative ones, always less in number than the positive ones show a slight fall. The heavy ions increase two-fold during the winter and the intermediate ones increase also, but only slightly. The heavy ion group shows a maximum at 8 a.m. and 6 p.m. in the winter (due to domestic fires and so forth) and at 8 a.m. only in the summer. The intermediate ions show minima at these times. The highest mobility occurs during the summer. Effects of winds, humidity, etc., have also been noted. H. M. B.

4931. Charge on Water Drops Falling through a Cloud of Charged Particles in a Vertical Electric Field. J. P. Gott. *Roy. Soc., Proc.* 151*A*. *pp.* 665–684, *Oct.* 1, 1935.—A preliminary part of the work consisted in developing methods for producing a cloud by cooling a mixture of steam and air, of giving the cloud a charge by exposure to ionisation in an electric field, and of producing a cloud containing equal numbers of + and — particles, by mixing two clouds carrying charges of opposite signs. This was followed by the measurement of the electrical conductivity of the cloud, and of other quantities related to it. The mobility of an individual cloud particle in strong electric fields was found to be less than the velocity of a falling water-drop. Measurements were made of the charge collected by a large water-drop while falling through a jet of the cloud containing equal numbers of + and — particles in a vertical electric field between two horizontal plates. When the upper plate was + the drop collected a — charge, and when the upper plate was — the drop collected a + charge. This is in agreement with a theory proposed by Wilson in connection with the mechanism of thunder-clouds. The quantitative agreement is as close as could be expected from the experimental arrangements. The experiments also afforded a test of the mechanism suggested by Elster and Geitel; any charge thus collected was too small to be observed. H. H. Ho.

4932. Terrestrial Electric Field, Atmospheric Ionisation and Vertical Current. A. Dauvillier. *J. de Physique et le Radium*, 6. *pp.* 420–426, *Oct.*, 1935.—Observations were carried out almost continuously at two (for part of the time at three) stations from Nov. 8, 1932, to Aug. 12, 1933. As regards the field, previous results are shown to be unsatisfactory; the average now observed was 71 V/m., with maximum (Nov.) 95 and minimum (April–May) 59 V/m., with a high diurnal variation in winter (105 V/m. at 18 hr. Gr., 72 at 2 hr.), but practically none in April–May. The field is affected by snow, rain and wind, but not by pressure, temperature, humidity or auroral activity. As regards conductivity, $\lambda^+ = 1\cdot40$, $\lambda^- = 1\cdot06$, average $2\cdot46 \times 10^{-4}$ sec.$^{-1}$, with diurnal variation the reverse of that of the field; number of small ions 10^3/cm.^{3}, the mobility of the negative being $>$ that of the positive. The vertical current (average $1\cdot7 \times 10^{-16}$ A/cm.^{2}) varies as the conductivity, and is attributed to a cosmic cause, and is the cause of the electric field. C. A. S.

4933. Numerical Character-Figures of Magnetic Disturbance in Relation to Geomagnetic Latitude. J. M. Stagg. *Terr. Mag.* 40. *pp.* 255–262, *Sept.*, 1935.—Mean values of $C_n = (HR_H + ZR_Z) \times 10^{-4}$, where R refers to the extreme daily range, were formed for 15 stations in descending order of magnetic latitude ϕ_m for the 13 months of the Polar year. The graph of C_n plotted against ϕ_m shows that in the neighbourhood of $\phi_m = 72°$ there is a zone characterised by intense magnetic disturbance on a scale probably about 12 times as great as at Eskdalemuir in a quiet year. The graph when extended to just beyond the magnetic equator falls to a minimum about 30°, after which it rises in a zone 20° broad centred on the magnetic equator. It is inferred that though the belt of maximum disturbance remains throughout the year between $\phi_m = 70°$ and 75°, the concentration is greater in winter. In summer it diffuses both to north and to south. The seasonal change, however, is greater in the vertical component than in the horizontal. The causes of disparities which occur are discussed. [See also Abstract 2041 (1935).] G. E. A.

4934. Magnetic Cartography. B. Weinberg. *Terr. Mag.* 40. *pp.* 325–331, *Sept.*, 1935.—The great majority of magnetic charts represent the smoothed or normal distribution of the magnetic elements, the usual distance between points of observation being far greater than 1 km. 39 small maps are reproduced, showing the distribution of D, H and Z over the Nikopol manganese-ore district, where 246 stations were distributed over 23 square km. These show how far from reality are the quasi-real isolines which are intended to show the distribution of a magnetic element as obtained by observations at stations distant 10 to 30 km. apart. 12 different methods of magnetic charting have been used. The writer suggests that two systems of isolines be drawn relating (1) to the epoch to which all the observations have been reduced, and (2) to some future epoch. An example of this type is given in a chart of Finland with the smoothed isogonics for 1935 and 1940. The desirability of organising an international service of universal magnetic charts is raised. G. E. A.

4935. Aspects of the Current System Producing Magnetic Disturbance. J. M. Stagg. *Roy. Soc., Proc.* 152*A*. *pp.* 277–298, *Nov.* 1, 1935.—The three mutually perpendicular force vectors of the earth's magnetic field added during disturbance to those acting on quiet days are examined. From the characteristics in magnitude and orientation of these disturbing vectors at seven observatories it is found that the overhead current system producing the regular diurnal disturbing field in moderately high latitudes is primarily concentrated in a narrow zone asymmetrically encircling the magnetic axis pole and at about 23° from it. The direction of this current flow is east-west in the early local morning and a maximum in the reverse direction about 18 hr. A systematic daily change of space distribution and azimuth of the lines of current flow accompanies the change in current direction. In winter the disturbance vectors further indicate that the current zone lies more northerly than in summer, but the seasonal displacement, like the daily, is probably to be attributed more to a changed distribution in the vertical of the lines of current flow than to a horizontal movement of the whole system. At all times the disturbing system is diffuse and complex. AUTHOR.

RADIOACTIVITY.

4936. Determination of Polonium Content from Salts in Thin Layers. Margarete Hoffer. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 3–4. *pp*. 131–134, 1935.—The ratios of the total activity of 1 gm. of salt to that of 1 cm.^{2} of a layer thereof of such thickness as gives maximum activity for active $Pb(NO_3)_2$, $PbSO_4$, $PbCl_2$, and $PbCO_3$ are respectively 232, 216, 202 and 201. The half life of Po is 138 days. C. A. S.

4937. Uranium Content of Sea Water. F. Hernegger and Bertha Karlik. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 5–6. *pp*. 217–225, 1935.—A known amount of the substance under examination is fused with NaF on a loop of Pt wire so as to form a bead precisely similar to a series of standard beads of NaF containing known amounts of U ($10^{-10} - 10^{-6}$ gm.). The fluorescent spectrum of such beads, produced by illumination with a Hg lamp, is photographed with suitable exposure (blackening is inversely proportional to U content for amounts $10^{-8} - 10^{-6}$ gm.), and the results compared photometrically. By this means the U content of sea water on the west coast of Sweden was determined as $0{\cdot}36 - 2{\cdot}3 \times 10^{-6}$ gm./l. C. A. S.

4938. Proof of Metallic Transformations by Radioactive Methods. O. Werner. *Zeits. f. Metallkunde*, 27. *pp*. 215–219, *Sept*., 1935.—The rate of emission of emanation from a metal containing Ra or ThX depends on its rate of diffusion through the metal and this, owing to the relatively large size of the atoms of emanation, particularly on the maximum frequency and amplitude of vibrations of the metal atoms. It accordingly varies approximately inversely as the "characteristic temperature" [see Abstract 3398 (1935)]. It is affected by anything that causes distortion or change in the lattice structure, or the size of the grains, as the grain boundaries necessarily have some effect on the rate of diffusion. Accordingly, rate of emanation emission/temperature-curves give information as to the course of such changes. This is exemplified by such curves showing the effect of heat on the recrystallisation of rolled Au, on Cu containing H, allotropic transformations of Tl, magnetic changes in Fe or Ni, and sintering of powdered Ni and Mo; in the case of Mo the effect of increased pressure on the sintering is clearly brought out. C. A. S.

4939. Ionisation by Single α-Particles. W. Jentschke. *Akad. Wiss. Wien. Ber.* 144. 2*a*. 3–4. *pp*. 151–173, 1935.—The ionisation per mm. of air by single α-particles from Po and ThC′ and the range of the particles are measured simultaneously by using two valve counters. One counter is connected to a small collecting electrode and one to a larger electrode of an ionisation chamber. The small electrode, the position of which is adjustable, is used to determine the specific ionisation at various points of the path of the particles and the larger electrode to determine the range. The ionisation curve of a single particle is similar to that of a parallel beam. The ionisation maximum occurs at a distance of $4{\cdot}4 \pm 0{\cdot}3$ mm. from the end of the path. The total number of ions produced by a single Po α-particle was measured and the connection between this number and range variation is discussed. W. E. P.

***4940. Counting α-Particles from Uranium. R. Schiedt.** *Akad. Wiss. Wien, Ber.* 144. 2*a*. 3–4. *pp*. 175–190, and 144. 2*a*. 5–6. *pp*. 191–211, 1935.—A detailed description of apparatus incorporating electrometer valves, for counting the α-particles from uranium. The number emitted per sec. by 1 gm. of U_1 was found to be $1 \cdot 264_5 \times 10^4 \pm 0 \cdot 70$ %, the corresponding decay constant of U_1 being $1 \cdot 567_3 \times 10^{-10}\, y^{-1} \pm 0 \cdot 70$ %. [See following Abstract.] W. E. P.

4941. Counting α-Particles from Uranium. F. Hecht. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 5–6. *pp*. 213–215, 1935.—An account of the determination of the weight of U in the two samples of uranium oxide used in the above investigation [see preceding Abstract]. W. E. P.

4942. Relation between Velocity, Range and Ionising Power of α-Particles. S. Meyer. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 5–6. *pp*. 317–330, 1935.—A comprehensive survey is made of available experimental results connecting α-particle range and velocity, and these are fitted to empirical formulæ. For α-particles of velocity v (in 10^9 cm./sec.) and mean range $\overline{R}$ (in cm. of air at 15° C. and 760 mm. Hg) the following formula is suggested, $\overline{R} + r = Av + Bv^2 + Cv^3$, where $r = 0 \cdot 26508$, $A = 2 \cdot 1856$, $B = -2 \cdot 5393$ and $C = 1 \cdot 7335$. Another form is $(v - v_1)^n = a\overline{R}$, where $v_1 = 0 \cdot 143$, $a = 0 \cdot 6648$ and $n = 1 + 1 \cdot 15185v - 0 \cdot 07441v^3$. A more useful form of the latter formula is $v^n = aR_r$, where R_r is the sum of the peak range in the Bragg ionisation curve and the constant r, given by $R_r + r = \overline{R} - 0 \cdot 2$, $a = 1 \cdot 0977$ and $n = 1 \cdot 67851 + 1 \cdot 16468\ v - 0 \cdot 23533\ v^2$. In the region of ranges from 3 to 11 cm. this formula reduces as a first approximation to the Geiger formula $v^3 = aR_r$. Tables are given showing the agreement between observed and calculated values of $\overline{R}$. When once the formula $v^3 = aR_r$ is established the equation $k = kR^{2/3}$ can be used to express the relation between range and ionising power.
J. E. R.

4943. Secondary Electrons of the Neutrino. M. Wolfke. *Acta Physica Polonica*, 4. 1–2. *pp*. 177–182, 1935. *In French*.—Assuming that the laws of conservation of energy and momentum apply to collisions between a neutrino and an electron the distribution of the energies of both after such collision has been calculated, that of the neutrinos on the assumption that their energy compensates the defect in the energy of the corresponding β-particles. The energies of the maximum number of β-particles, neutrinos and secondary electrons are respectively $0 \cdot 22$, $0 \cdot 98$ and $0 \cdot 78 \times 10^6$ eV ; and the velocity of the last named about $0 \cdot 92$ of the velocity of light with maximum $0 \cdot 94$, which corresponds to paths in air of 230 and 310 cm., so that this should be observable by means of a Wilson chamber. [See Abstract 3412 (1935).] C. A. S.

4944. Excitation of Secondary γ-Rays by β-Rays. E. Stahel and P. Kipfer. *Helv. Phys. Acta*, 8. 6. *pp*. 508–511, 1935. *In French*.—β-rays from UX were allowed to fall on radiators of Pb, Pt, Sn, Ag, brass, Al and pasteboard, and the secondary γ-radiation was examined in a high pressure Wilson chamber after passing through Pb screens of varying thickness. The secondary γ-radiation consists of two components with $\mu_{Pb} = 2 \cdot 9$ and $1 \cdot 0$ cm.$^{-1}$, with perhaps a third of the same hardness as the primary ($\mu_{Pb} = 0 \cdot 70$). The intensity increases linearly with the atomic number of the radiator. It is concluded that the secondary γ-radiation is due to deceleration of the primary β-rays in the atoms of the radiator, and suggested that the primary γ-radiation is due to internal deceleration of primary β-rays within the emitting atoms. Preliminary measurements with Ra E lead to similar conclusions. C. A. S.

4945. Pair Production by Magnetic Multipole Radiation. J. C. Jaeger. *Cambridge Phil. Soc., Proc.* **31.** *pp.* 609–611, *Oct.*, 1935.—Pair production by internal conversion of magnetic multipole radiation is discussed with reference to results obtained by Taylor and Fisk for internal conversion of K-electrons [see Abstract 3650 (1934)]. In distinction from these, the magnetic terms are now found to be initially smaller than the electric, whilst the probability of pair production decreases with the order of the multipole. [See also Abstract 1096 (1935).] C. B. A.

4946. Absence of Appreciable γ-Ray Emission in Collisions between Rapid Neutrons and Protons. Thérèse Grivet-Meyer. *Comptes Rendus*, **201.** *pp.* 658–660, *Oct.* 14, 1935.—With a source of Po + Be (40 m. curie) placed on the median plane between, and about 10 cm. from, two Al Geiger-Müller counters arranged according to the Rossi method, the number of coincidences with the source bare was 7·2/min., which was unchanged when a screen of borax was interposed. If, however, the source was surrounded with paraffin the numbers were 11·1 without and 6·2 with the borax. It is concluded that the increased number when the source was thus surrounded (but without the borax) is due to the enhanced action on the Al shells of the counters, of the neutrons slowed down by the H of the paraffin [see Abstract 1899 (1935)]. This may explain Lea's results [see Abstract 3416 (1935)]. C. A. S.

4947. Coefficient of Absorption of γ-Rays of Radium in Beryllium. J. Starkiewicz. *Acta Physica Polonica*, **4.** 1–2. *pp.* 79–84, 1935. *In French.*—The intensity (I) of γ-rays from 200 mg. Ra (contained in Pt tubes), filtered through 5 cm. Pb. and passed through thicknesses (t) of 3·03–9·45 cm. Be was measured by a Geiger-Müller counter distant 3 m. The log I/t curve is accurately a straight line, giving the coefficient of absorption (μ) = 0·0744 cm.$^{-1}$, and cross-section of an electron, σ_e = $1{\cdot}49 \times 10^{-25}$ cm.^{2} Agreement with calculations by the Klein-Nishina formula (λ = 6·4 X.U.) is exact, and μ for Be agrees with its values for other light elements, being unaffected by the disintegrating effect of γ-rays on Be nuclei. [See Abstract 4196 (1935).] C. A. S.

See also Abstracts 4759, 4761, 4768, 4769, 4770, 4771, 4919, 5072, 5079, 5157.

RADIATION.

ABSORPTION AND TRANSMISSION.

4948. Constitution and Colour of Glasses Containing Iron and Manganese Oxides. W. E. S. Turner and W. Weyl. *Soc. Glass Technol., J.* 19. *pp.* 208–216, *Sept.,* 1935.—A spectroscopic study of glasses containing Fe and Mn oxides, both separately and in conjunction, supported by a consideration of the colours produced by oxides and salts of manganese in aqueous, hydrochloric acid, and vitreous solutions, as well as in solution in organic solvents, has led to the conclusions that (1) the proportion of the purple-colouring Mn_2O_3 in a manganese-containing glass increases with increasing concentration, but in any case is very small compared with that of the faintly colouring manganous oxide; (2) the Mn_2O_3 is very sensitive to the reducing action of FeO present; (3) glasses containing 2 % iron oxide and manganese oxides up to 4 or 5 % are relatively transparent to light by reason of the reduction of purple Mn_2O_3 by FeO to relatively colourless MnO, and the corresponding oxidation of bluish-green FeO to the golden-brown and more transparent Fe_2O_3; (4) in mixed iron and manganese oxide-containing glasses the ultimate colour depends on the total Fe_2O_3 and MnO present. AUTHORS.

4949. Coloration by Kathode Rays. H. Nagaoka and T. Mishima. *Inst. Phys. and Chem. Research, Tokyo, Sci. Papers, No.* 603. *pp.* 77–94, *Oct.,* 1935. *In English.*—The sample under examination is bombarded by a narrow beam of kathode rays. Coloured spots are obtained corresponding to accelerating voltages from 0 to 10 kV. The dependence of coloration on electron current and time of exposure is also studied. When intensities of coloration are plotted against $V^{3/2}$—assumed proportional to the range of the electrons—the curve shows changes of slope at voltages corresponding to excitation of the K, L, M, etc., X-radiations of the elements present in the sample. A large number of substances have been investigated [see Abstract 581 (1934)]. The coloration is attributed, tentatively, to dissociation of the compounds by the kathode rays. It is also suggested that electron bombardment may disturb the crystal lattice near the surface, causing coloration. C. J. B. C.

4950. Atmospheric Absorption Coefficients. Part II. J. Duclaux. *J. de Physique et le Radium,* 6. *pp.* 401–406, *Oct.,* 1935.—For Part I of this work [see Abstract 3827 (1935)]. The present section deals with the results of 26 series of measurements. The author shows that these can be interpreted in two ways :—(1) If the molecular diffusion takes place according to Rayleigh's law, the absorption of the atmosphere is the sum of at least three terms beyond that corresponding to the diffusion; (2) if the coefficients given by Rayleigh's theory be regarded as 30 % too high, all the results can be explained by two terms beyond the term of molecular diffusion. The author considers that this greater simplicity while not an argument against Rayleigh's theory, shows that the theory cannot serve as a complete guide in an investigation of the actual atmosphere. Besides the absorption which increases regularly from the red to the ultra-violet, a selective absorption occurs, with a maximum in the blue. This absorption varies from day to day. This, in the author's opinion, may be attributed to the presence of NO_2 though the evidence so far is not entirely conclusive. A. E. M. G.

***4951. Cyanine Dyes as Light Filters. W. Dieterle.** *Zeits. f. wiss. Phot.* 34. *pp.* 241–244, *Oct.*, 1935.—Certain of the cyanine dyes may be used with advantage as light filters owing to their sharp-cut absorptions and their high degree of light-fastness. Examples are: benzthiocyanine, a yellow (minus violet) filter completely transparent to blue but opaque to violet and ultra-violet (extinction limit 450 mμ); benzthio-pentacarbocyanine, a blue filter with main extinction limit 510 mμ and a subsidiary limit at 840 mμ; naphthothio-heptacarbocyanine, a green filter with extinction limits at 580 and 920 mμ. The first may be used as a photographic taking filter; the second (alone) as a blue-separation filter in colour photography or (combined with a red filter) as a " black " filter passing only infra-red above 840 mμ; the third as a dark-room safelight filter or as a green-separation filter giving an exceptionally pure yet intense spectral green. L. V. C.

See also Abstract 4917.

COLORIMETRY.

4952. Variations in Colour Vision and Colour Measurement. T. Smith. *Phil. Mag.* 20. *pp.* 1055–1062, *Nov.*, 1935. *Supplement.*—Wide variations in the coordinates of colours, which according to Houstoun and Younger [see Abstract 2963 (1935)] are obtainable by individuals of normal colour vision and considered by them an objection to the use of the C.I.E. system, are shown to be due to errors of calculation or theory. The views of these authors on the unreliability of both direct and indirect colour measurements on the C.I.E. system are not in agreement with experience at the National Physical Laboratory. AUTHOR.

ELECTRO-OPTICAL AND MAGNETO-OPTICAL EFFECTS.

4953. Magnetic Double Refraction and Light Scattering in Fused Nitrates. V. N. Thatte. *Indian Acad. Sci., Proc.* 2A. *pp.* 244–248, *Sept.*, 1935.—The paper gives an account of measurements on the light scattering and magnetic double refraction of some fused nitrates. The magnetic and optical anisotropies of the NO_3 group are calculated therefrom, and are found to be the same as for the NO_3 group, in nitric acid and in crystalline nitrates. AUTHOR.

4954. Temperature Dependence of the Kerr Effect in Nitrobenzene. W. Herzog. *Zeits. f. Physik*, 97. 3–4. *pp.* 233–241, *Oct.* 11, 1935.—The dependence on temperature of the Kerr effect in nitrobenzene near the Wolfke-Mazur transformation point [see Abstracts 2483 and 3216 (1932)] was measured in order to establish whether an unsettlement of the Kerr constant occurred on passage through this point. Such inconstancy could not be observed, and as the nitrobenzene used by the author was thoroughly purified he considers that the transformation point found by Wolfke and Mazur must be imputed to unpurified nitrobenzene. J. J. S.

4955. Magnetic Birefringence in Solutions of Paramagnetic Salts of Rare Earths. S. W. Chinchalkar. *Phil. Mag.* 20. *pp.* 856–858, *Nov.*, 1935.—Recently Haenny [see Abstract 1099 (1935)] has published values of magnetic birefringence for practically the whole series of rare earths. His values for solutions of different salts refer to different concentrations and for intercomparison it is desirable to reduce them to the same equivalent concentration. The author gives the values in tabular form reduced to concentrations of the Yb solution employed by Haenny, assuming that the variation of magnetic birefringence with concentration follows a linear law. The values reveal great regularity, and since it is known that the rare earth series is divisible into two halves corresponding to erect and inverted multiplet intervals respectively, in both halves of the present table are shown values in which the orbital values undergo similar variation. In each half the magnetic birefringence has a large negative value for the first member which becomes less in magnitude for successive members, ultimately becoming positive. The relationship between the birefringence and the orbital moment of the ion is thus established. The variations indicate that the angle between the magnetic moment of the ion and the direction of its maximum optical polarisability varies as the different 4*f* electrons are added to form the successive members in each half of the rare-earth series. S. G. B.

See also Abstract 4781.

FLUORESCENCE AND PHOSPHORESCENCE. LUMINESCENCE AND AFTERGLOW.

4956. Fluorescence of Fluorites. Part III. H. Haberlandt, Berta Karlik and K. Przibram. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 3–4. *pp*. 77–85, 1935.—A continuation of previous work [see Abstract 3247 (1934)]. A further detailed account of the lines found in the fluorescence of various fluorites excited by u.v. light. J. E.

4957. Fluorescence of Fluorites. Part IV. H. Haberlandt, Berta Karlik and K. Przibram. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 3–4. *pp*. 135–140, 1935.—After strong heating fluorite shows a green U band whose intensity gives an indication of the U content. A rule given previously is restated; the yellow green fluorescence of Yb at low temperatures is more dominant the nearer the origin of the fluorite to the acidic volcanic rocks. This is also closely connected with the relative concentrations of Yb and Eu. J. E.

4958. Fluorescence of Fluorites. Part V. K. Przibram. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 3–4. *pp*. 141–151, 1935.—Pure $EuCl_2$ (Jantsch) shows a bright purple fluorescence whose spectrum gives a blue band, a sharp red band at 690, and a diffused red band at 630 Å, all corresponding to fluorite bands. Eu in alkali halides fluoresces with the blue and red bands after radium treatment and heating respectively. The blue band is a sensitive indicator of Eu down to a concentration of 10^{-6}. J. E.

*4959. **Fluorescence in Cyclohexane. R. Padmanabhan.** *Indian Acad. Sci., Proc.* 2*A*. *pp*. 209–212, *Sept*., 1935.—An apparatus for continuous distillation is described. With its help pure cyclohexane is shown to have no fluorescence; that reported by Haberl [see Abstract 236 (1935)] is proved to be due to products of photochemical decomposition. The wave-lengths in the region 2400–2600 Å are found to be active in the above reaction.

4960. Rôle of the Redox Potential and of Acidity in the Extinction of Fluorescence in Solutions. K. Weber. *Zeits. f. phys. Chem.* 30. *Abt.B.* 1. *pp*. 69–83, *Sept*., 1935.—Investigation of the extinction of the fluorescence of quinine sulphate, æsculin and uranine by halogen ions in solutions of different acidity reveals a simple relation between the extinction power and the normal potential of the ions. With quinine sulphate and æsculin, the logarithm of the half-value concentration increases linearly with such potential, if this is positive. With uranine fluorescence the relation is more complicated. The effect of acidity is always such that the extinction increases as the H-ion concentration increases. Regarding the extinction by halogen ions as a sensitised photo-oxidation, a reaction mechanism is assumed which, with the help of the laws of chemical kinetics, leads to extinction formulæ capable of experimental confirmation. No similar relation is observable in the extinction of the fluorescence of quinine sulphate, æsculin or sodium naphthionate by different kations (as sulphates). T. H. P.

4961. Polarised Fluorescence in Organic Compounds. S. M. Mitra. *Zeits. f. Physik*, 97. 3–4. *pp.* 138–153, *Oct.* 11, 1935.—The polarisation of the fluorescence radiation from succinyl fluorescein and succinyl eosin solutions is studied in relation to the temperature, viscosity and concentration of the solutions, and to the wave-length of the exciting radiation. C. B. A.

4962. Energy Transfer in Collisions of Excited Thallium Atoms with Gas Molecules. N. Prileshajewa. *Acta Physicochimica*, 2. 5. *pp.* 647–664, 1935. *In German.*—The quenching effect of N_2, O_2, H_2, CO_2, CO, H_2O, molecules and atoms on the emission of the green Tl line (5351 Å) has been investigated, the excited Tl being obtained from photo-dissociation of TlI molecules. The effective cross-section for the quenching process is of the order 10^{-15} cm.^{2} and in the case of O_2 and CO_2 depends on the velocity of the excited Tl atoms. In these two cases the process is interpreted as a chemical change leading to the formation of TlO molecules. The collisions with the other gases are of the second kind with energy transference to the vibrational and rotational energy of the colliding partners. Hydrogen produces no quenching. After a summary of all the known data on the quenching of Na, Hg and Tl fluorescence, conclusions are drawn as to the probability of energy transfer. The dependence of the cross-section on the velocity is explained in terms of the potential curves of the systems. J. E.

4963. Action of Hydrogen Bromide on Nitrogen Afterglow. W. H. Rodebush and M. L. Spealman. *Am. Chem. Soc., J.* 57. *pp.* 1881–1882, *Oct.*, 1935.—The relative intensity of certain transitions in the nitrogen afterglow is greatly altered by the presence of HBr or Br_2, but the band spectrum of Br_2 was not observed. AUTHORS.

4964. Air Afterglow. F. H. Newman. *Phil. Mag.* 20. *pp.* 777–781, *Nov.*, 1935.—The spectra of air and oxygen afterglows are examined in detail. A current of gas is drawn through a vacuum tube and the afterglow examined in a side tube, a constant deviation spectrograph being employed. It is concluded that both the afterglows arise from the oxidation of NO by O_3, both gases being formed in the discharge tube. A. H.

✱4965. New Electric Spark-Gap. J. Zieliński. *Acta Physica Polonica*, 4. 1–2. *pp.* 135–138, 1935. *Abstract in French.*—An apparatus for the study of feeble fluorescence excited by a spark is described. It has a high light efficiency and is steady in operation. In observations of the fluorescence of saturated Hg vapour made with it, exposures only one sixth to one-eighth of those usually required needed to be given. C. B. A.

See also Abstract 5028.

INTERFERENCE. DIFFRACTION AND SCATTERING.

4966. Longitudinal Light Scattering (Plotnikow Effect). B. Čoban. *Acta Physica Polonica*, 4. 1–2. *pp.* 1–16, 1935. *In German.*—

The longitudinal light scattering is observed in pentane, hexane, cyclohexane, benzene, heptane, nouane, paraffin oil, solutions of colophonium in CCl_4, and in suspensions of starch of varied molecular size, and the dependence of the scattering on molecular size and structure is investigated. The early part of the paper is devoted to an account of the effect and previous experiments on it, and some of the difficulties in carrying out the experiments are specified together with the best ways of overcoming them. A. C. M.

4967. Doppler Effect in Light Scattering in Liquids. Part II. Polarisation of Transversely Scattered Radiations. B. V. R. Rao. *Indian Acad. Sci., Proc.* 2*A*. *pp.* 236–241, *Sept.*, 1935.—The present paper describes a study of the state of polarisation of the three components observed in the spectrum of the scattered light when examined with a Fabry-Perot etalon. Three typical liquids, carbon tetrachloride, toluene and carbon disulphide have been examined. The results indicate that the two Doppler components are completely polarised as is to be expected, and that the central component is practically completely polarised. The significance of the latter result which appears surprising at first sight, is discussed in some detail. [For Part I see Abstract 3426 (1935).] AUTHOR.

See also Abstracts 4781, 4953, 5127, 5128, 5130.

PHOTOCHEMISTRY (INCLUDING PHOTOGRAPHY).

4968. Detection of Free Radicals Produced in Photo-Dissociation. W. West. *Am. Chem. Soc., J.* 57. *pp.* 1931–1934, *Oct.*, 1935.—An attempt is made to detect the presence of free radicals in photodissociations by making use of the effect discovered by Farkas and Sachsse of the paramagnetic interconversion of ortho and para hydrogen. Conversion in excess of any possible spurious effect was found to be produced by methyl iodide and acetone vapours illuminated to radiation of frequency in their continuous absorption regions, and not by propionyl aldehyde nor benzene. The results are interpreted as indicating the production of paramagnetic free radicals on illumination of methyl iodide and acetone. The occurrence of conversion from acetone and not from propionyl iodide is strong evidence in support of Norrish's hypothesis of a difference in mechanism in the photo-dissociation of aliphatic aldehydes and ketones. AUTHOR.

4969. Free Radicals in the Photo-Dissociation of Gaseous Metal-Alkyls. N. Prileshajeva and A. Terenin. *Faraday Soc., Trans.* 31. *pp.* 1483–1487, *Nov.*, 1935.—The method of detection of free alkyl radicals based on the disappearance of metal layers under their action (Paneth) is improved by measuring the thickness of the layer with the help of a photometric device with a photo-cell. The method is applied to the detection of alkyl radicals produced in the vapours of acetone, mercury dimethyl and tetra-ethyl lead under the action of the ultraviolet light from a spark. With the help of different electrodes and light filters the range of the most effective wave-lengths is estimated. AUTHORS.

4970. Effect of Imprisonment of Resonance Radiation in the Decomposition of NH_3 and ND_3. H. W. Melville. *Roy. Soc., Proc.* 152*A*. *pp.* 325–341, *Nov.* 1, 1935.—Velocity coefficients of mercury photosensitised reactions are usually determined by comparison with the mean life of the excited $^3P_1$ atom, presumed constant. At high Hg-vapour pressures (0·001 mm.) the appreciable re-absorption of resonance radiation renders the effective mean life much larger than its actual value of 10^{-7} sec. Re-examination of the decomposition of NH_3, ND_3, PH_3 and PD_3 shows that, when the conditions are such that re-absorption is negligible, the expected smaller values for the velocity coefficients are obtained. As regards the behaviour of NH_3 and ND_3 molecules, it is suggested that the dissociation is brought about in collisions between NH_3 (ND_3) and metastable atoms, derived in turn from quenching collisions between $^3P_1$ atoms and NH_3 (ND_3); the former collisions are almost equally efficient for NH_3 and ND_3. Such mechanism explains also the abnormally high inhibitory effect of hydrogen. Secondary reactions, unconnected with Hg atom processes, are assumed to explain why NH_3 decomposes more rapidly than ND_3. T. H. P.

4971. Photographic Development Effect. P. O. Hofmann. *Phys. Zeits.* 36. *p.* 650, *Oct.* 1, 1935.—In the region of reciprocity-law failure, if a plate is exposed at various intensities for various times such as to give the same final density on prolonged development (metol-hydroquinone), the image first appearing in the earlier stages of development is that due to a longer exposure at a lower intensity level. L. V. C.

4972. Infra-Red Photography Beyond λ 1000 mμ. W. Dieterle and W. Zeh. *Zeits. f. wiss. Phot.* 34. *pp.* 245–250, *Oct.*, 1935.—Extension of the polymethine chain in sensitising dyestuffs of the carbocyanine type (König's *nona-* and *undeka-*carbocyanines) has permitted the production of the Agfa "950" and "1050" infra-red plates, with sensitising maxima at 950 and 1050 mμ respectively. It is hoped to produce plates of still further application in astronomical spectro-photography by further extension of the polymethine chain in such dyes and by replacing the oxy-acyl group in the chain by hydrogen. The existing plates have reasonable stability, especially if stored at liquid-air temperatures and can with advantage be hypersensitised immediately before use. L. V. C.

4973. Properties of Halogen Silver Peptised in Gelatin by Ultrasonic Waves. H. W. Dangers. *Zeits. f. Physik*, 97. 1–2. *pp.* 34–45, *Sept.* 23, 1935.—The photographic behaviour of emulsions produced by the action of h.f. vibrations without the addition of chemicals was systematically investigated. The effect of temperature treatment of the emulsions on their properties was determined, and it was found that, with suitable conditions of formation, emulsions of the highest sensitivity could be produced. The importance of the surface condition of the halogen silver grains before addition of the gelatin solution in determining the properties which the emulsion acquires by a ripening process after the addition of the gelatin is emphasised. [See also Abstract 2976 (1935).] G. E. A.

4974. Theory of Photographic Recording. H. Kaiser. *Zeits. f. techn. Physik*, 16. 10. *pp.* 303–313, 1935.—The author is concerned with the registration of the form of a vibration by photographing on a moving film a light spot reflected from a mirror attached to the vibrating system, or alternatively by photographing the "shadow" of a vibrating thread. The factors, photographic and optical, determining the fineness and other features of the trace are discussed in relation to such questions as the maximum resolvable vibration frequency, registration of large amplitudes, etc. W. S. S.

4975. Colour-Temperature Determination of Flashlamps. J. A. M. v. Liempt and J. A. de Vriend. *Zeits. f. wiss. Phot.* 34. *pp.* 237–240, *Oct.*, 1935.—By comparing the spectrograms obtained with a Lagorio colour chart, exposing in turn on the same panchromatic material to light from the flashlamp (Philips' "Photoflux") and from other sources of known colour-temperature, the colour-temperature of the flashlamp emission, due to rapid combustion of Al and Mg in O_2, is estimated at approx. 4000° K. L. V. C.

See also Abstracts **4766, 4823, 4951, 4962, 5013, 5028, 5030, 5031, 5043, 5104.**

PHOTOMETRY.

***4976. Selectivity of Photometric Integrators. F. Benford.** *J.O.S.A.* 25. *pp.* 332–339, *Oct.*, 1935.—A treatment, mainly mathematical, of the effect of selectivity in the paint used for coating the inside of a photometric integrator. The author calculates the magnitude of the error to be expected when measuring coloured light sources of various kinds (including discharge tubes) when the integrator surface is covered with a particular paint, the composition of which is not given in the paper. J. W. T. W.

***4977. Selectivity of Photometric Integrators, and Photometry of Gas Discharge Tubes. H. Buckley.** *Phil. Mag.* 20. *pp.* 745–761, *Nov.*, 1935.—The paper gives a theoretical treatment of the effect of selectivity of photometric integrators in producing errors in the determinations of the luminous outputs of incandescent lamps and gas-discharge lamps. The dependence of the error on the method used is investigated. It is shown that in suitable easily realised circumstances measurements of the luminous outputs of neon, sodium, high-pressure and low-pressure mercury lamps should not be in error by more than 1 % due to the selectivity of the photometric integrator. AUTHOR.

POLARISATION.

4978. Polarisation of Continuous X-Rays from a Thin Aluminium Anti-Kathode. H. P. De. *Indian Journ. Phys.* 9. *pp.* 507–516, *Sept.*, 1935.—An experimental method is described for observing the state of polarisation of the continuous X-rays from a thin Al anti-kathode along different directions of emission. The X-rays emitted from a thin anti-kathode are allowed to pass through a Wilson chamber and the initial direction of ejection of the photoelectrons is observed. From such observations the state of polarisation is found to be 52 % along 90° with the line of flight of the kathode particles; 12·5 % along 30° with the line of flight, and 4 % along 0°, *i.e.*, along the direction of motion of the kathode particles. The results are discussed in the light of the experimental results of other observers and the theoretically expected values of Sommerfeld and Sugiura. AUTHOR.

4979. Polarisation Measurements in Liquefied Gases. A. I. Schattenstein. *Acta Physicochimica*, 3. 1. *pp.* 53–60, 1935. *In German.*—A method of determining the rotation of the plane of polarisation by dissolving optically active substances in liquefied gases is described and their use in investigations of the speed of catalytic reactions. Results are given of the determination of the specific rotation of saccharose solution in liquid ammonia and of solutions of santoninic acid amides in presence of salts in liquid ammonia. R. L.

***4980. Mica Half-Shade Compensator of Szivessy and Dierkesmann. W. Herzog.** *Zeits. f. Physik*, 97. 3–4. *pp.* 225–232, *Oct.* 11, 1935.—For the calculation of the final results when using the Szivessy and Dierkesmann half-shade compensator, which consists of a half-shade plate and an analyser [see Abstract 1589 (1932)], the phase difference Δ of the half-shade plate was always determined by a separate measuring device. This paper shows that this is unnecessary and describes an experimental arrangement and gives the theoretical justification for it, of determining Δ using the Szivessy and Dierkesmann compensator only. R. L.

***4981. Construction and Use of a Quartz Quarter-Wave Compensator. G. Bruhat and L. Weil.** *Comptes Rendus*, 201. *pp.* 719–721, *Oct.* 21, 1935.—A description is given of a compensator, approximately quarter-wave between 3000 and 2550 Å, which is formed from two quartz plates cut parallel to the axis and crossed, their thicknesses being 107·7 and 101·3 μ respectively. C. B. A.

See also Abstracts 4967, 5068.

RADIATION, EMISSION.

4982. Analysis of Heat Interchange by Radiation between Diffuse Surfaces. G. Poljak. *Techn. Phys., U.S.S.R.* 1. 5–6. *pp.* 555–590, 1935. *In German.*—A method is developed for the calculation of the heat interchange by radiation between diffuse surfaces, which depends on the formation of equations representing the difference between the total incoming and outgoing radiation energy at the surface. The method is used for the solution of a number of typical problems. R. W. P.

4983. Absorption of Electric Waves. G. Petrucci. *N. Cimento*, 12. *pp.* 361–367, *June*, 1935.—Mention is made of the few methods in use for the measurement of absorption of electric waves in various media. A description is given of a very simple and sensitive method of obtaining the absorption, not only in ordinary media, but also in the tissues of the living human body. An experiment is described using waves of from 3 to 15 m. and power of 200 W with solutions of NaCl of various strengths. The result is in agreement with the Debye-Falkenhagen theory. H. M. B.

4984. Electromagnetic Wave of Discontinuity. F. J. Wiśniewski. *Acta Physica Polonica*, 4. 1–2. *pp.* 17–22, 1935. *In French.*—It is shown that a surface of discontinuity in the first derivatives of the electric and magnetic field vectors, propagated in an anisotropic medium, can increase the kinetic energy of electric charges in the medium at the expense of the electromagnetic energy of the medium. Thus, sources of such waves of discontinuity can heat distant bodies, not by absorption of energy associated with the wave, which is in fact zero, but at the expense of the energy of the electromagnetic field of the bodies traversed by the wave. W. S. S.

4985. Rock-Salt Absorption of Cosmic Rays. S. Ziemecki. *Acta Physica Polonica*, 4. 1–2. *pp.* 183–193, 1935. *In English.*—Measurements of residual ionisation were taken at a depth of 406 m. in a salt mine, with a 200 m. layer of rock-salt over the apparatus. With an iron shield 9 cm. thick over the apparatus the ionisation was 3 % less than in the unshielded chamber, the difference being attributed to radioactive substances in the air which is pumped into the mine from outside. Without the shield a remarkable constancy in the ionisation was observed, and consequently the author does not agree that the fluctuations commonly observed in measurements of this kind are statistical in origin. Measurements of intensity at different depths up to 3 m. in a mound of salt dust show that the mass-absorption coefficient for rock-salt is much less than for water. D. H. F.

4986. Corpuscular Theory of Primary Cosmic Radiation. W. F. G. Swann. *Phys. Rev.* 48. *pp.* 641–648, *Oct.* 15, 1935.—The author develops his hypothesis [see Abstracts 2531 and 4567 (1935)] that the primary cosmic rays produce secondaries in number per cm. of path proportional to the primary energy. It is modified to permit an increase of coefficient of apparent absorption with decrease of primary energy, and it is shown that this modification can be made in more than one way. A distribution of the primary rays over a range of energy is also required. A modification of the foregoing theory permits the apparent primaries referred to in it to be really photons produced by impact of true primary charged particles in the upper atmosphere. A former hypothesis, designed to provide an explanation for the fact that the number of bursts and showers increases more rapidly with height than does the measured cosmic ray intensity, is also incorporated. A list of eleven facts concerned with cosmic ray absorption, latitude and directional effects, burst and shower production is made, and it is shown that the extended theory covers all of them. D. H. F.

4987. Primary Cosmic Ray Energy and Burst Production. W. F. G. Swann and D. B. Cowie. *Phys. Rev.* 48. *pp.* 649-652, *Oct.* 15, 1935.—Counters are arranged above and below an iron ionisation chamber, so as to record by coincidence measurements rays passing vertically through the chamber. The ionisation was recorded and the number of bursts involving more than 2×10^6 occurring simultaneously with coincident discharges of the counters found. A similar set of readings was obtained with counters placed to record rays entering at 45° to the vertical. The ratio of intensities, as measured by the counters, was 1·5 to 1 for the two directions, and the numbers of bursts were in the ratio 10 to 1. This ratio is shown, on the basis of the general ideas formulated as controlling the phenomenon, to agree sufficiently well with that to be expected from other experiments. D. H. F.

4988. Frequency and Magnitude of the Showers Liberated by Cosmic Rays in Lead. H. Geiger and O. Zeiller. *Zeits. f. Physik,* 97. 5–6. *pp.* 300–311, *Oct.* 18, 1935.—Under various geometrical conditions a count was made of the threefold and fourfold coincidences which the cosmic rays showers going out from Pb produce in a counting tube arrangement. From the numbers found it is calculated that out of a sheet of Pb 1·5 cm. thick there issue on the average 0·6 shower per hour per sq. cm. From the same observations a statement of the magnitude of the showers may be given. If these consist only of ionising rays, *e.g.*, electrons, there would belong to a shower six such rays on the average. If, however, in accordance with the views of Geiger and Fünfer [see Abstract 1599 (1935)] the showers are composed of pairs of electrons of very high energy (C-rays) and of a retardation radiation liberated by them (D-rays), then, with each C electron from a Pb plate there must emerge about 200 D quanta. On this supposition not only can the Fünfer " back ray effect " be easily explained, but also the anomalies in the absorption of shower rays observed by Zeiller. Farther it can be established by direct evidence of an absorption

curve that the mean absorption coefficient of the D-rays amounts to about 1 cm.$^{-1}$ Pb. This represents a quantum energy of about 6×10^6 eV.
J. J. S.

***4989. Gaseous Discharge Tube as Intense Source of Continuous Ultra-Violet Radiation. R. H. Munch.** *Am. Chem. Soc., J.* 57. *pp.* 1863–1865, *Oct.*, 1935.—A simple l.v. H_2 discharge tube especially designed as an intense source of continuous u.v. radiation is developed. It requires no water-cooling, since it produces the same light intensity with only about 5 % of the electrical power required by a h.v. H_2 discharge tube. Details of construction and operation are given. In addition to being useful as a source of continuous radiation it has been used as a source of the line spectra of Hg and the rare gases. AUTHOR.

See also Abstracts 4975, 5185.

RADIATION, GENERAL THEORY.

4990. Neutrino Theory of Light. R. de L. Kronig. *Physica*, 2. *pp.* 968–980, *Nov.*, 1935. *In German.*—Further develops the theory of neutrino fields outlined in previous papers [see Abstract 4232 (1935)]. The possibility of a β-ray disintegration of the nucleus induced by radiation, is suggested by the present theory. W. S. S.

RADIATION, MECHANICAL EFFECTS.

4991. Influence of Light on Brownian Motion. R. Fürth and O. Zimmermann. *Ann. d. Physik*, 24. 2. *pp.* 183–208, *Oct.*, 1935.—The first author contributes a theoretical discussion and the second the more practical issues. A series of papers and results from Popišil [see Abstract 3467 (1935)] are studied to find the influence of light on the Brownian motion in Au and rubber minute particles, between 0·1 and 1 μ in dia. The following conclusions are reached: (1) The illumination of the particles with unpolarised light of intensity 0·00062 W/cm.^{2} up to 2·6 W/cm.^{2} has no measurable influence on the Brownian motion. This is valid for all materials, for all particle-sizes and for all wave-lengths. The Brownian motion is just as great along the direction of the light as at right angles. (2) Illumination of the particles with linear polarised light shows that the square of the displacement in the direction of the magnetic vector of the light vibration is independent of the particle material or size, but is about 7 to 11 % greater than in the direction of the electrical vector, when observed in the direction of light propagation for the maximum light intensity used. The results are partially in contrast to those of Popišil. The sources of error creating these discrepancies are pointed out. An explanation of the various phenomena is given on the basis of an electro-optical effect. Full experimental details are included. S. G. B.

REFLECTION. REFRACTION AND DISPERSION.

4992. Refractometric Investigations of Aqueous Solutions of Mixtures of Salts. G. Spacu and E. Popper. *Zeits. f. phys. Chem.* 30. *Abt.B.* 2–3. *pp.* 113–116, 1935.—By following the change of the specific refraction with composition in aqueous solutions containing $BaCl_2$ and KCl, the existence of two complex anions, corresponding with the two compounds $[BaCl_4]K_2$ and $\left[Ba\begin{matrix}Cl_5\\(H_2O)\end{matrix}\right]\begin{matrix}Ba\\K\end{matrix}$, is confirmed. [See Abstract 2481 (1934)]. T. H. P.

***4993. Cellular Construction of Telescope Mirrors. A. Couder.** *Comptes Rendus,* 201. *pp.* 595–597, *Oct.* 7, 1935.—A number of sources of defects in the optical quality of cellular telescope mirrors are described and discussed. C. B. A.

***4994. New Systems for Microphotography and Microprojection. A. Köhler.** *Zeits. f. Instrumentenk.* 55. *pp.* 407–415, *Oct.,* 1935.—In continuation of previous work [see Abstract 1132 (1935)] an account is given of new lens systems suitable for microphotography and microprojection. C. B. A.

See also Abstracts 4835, 4948.

SPECTROSCOPY.

4995. Wave-Length Shifts of the Spectral Lines of Tin Due to Change of Pressure. T. Yuasa. *Tokyo B.D., Sci. Reports, No.* 45. *pp.* 267–277, *Sept.* 30, 1935.—Wave-length shifts of the spectral lines of Sn I, Sn II, and Sn III excited at relatively high pressure have been investigated and the results are discussed in relation to the spectral series. It is found that the larger the inner quantum number j, the larger becomes the wave-length shift. No definite correlation is obtainable, however, between the shifts and the principal quantum number n. It is found that the arc lines suffer no appreciable shift when the pressure is increased, but their appearance changes considerably. The principal series in Sn II and Sn III, in general, seem to be less affected than the other series. A. H.

4996. Fine Structure of the Metastable Level of Nitrogen. B. Stepanoff. *Phys. Zeits. d. Sowjetunion* 8. 3. *pp.* 352–353, 1935. *In German.*—A record of some spectrographic observations. The values found for the magnitude of the splitting of the lines 1742·740Å and 1745·260Å are 2·16 cm.$^{-1}$ and 2·13 cm.$^{-1}$. J. J. S.

4997. Vacuum Arc Spectrum of Rubidium and Lithium. S. Datta and P. C. Bose. *Zeits. f. Physik,* 97. 5–6. *pp.* 321–329, *Oct.* 18, 1935.—The wave-lengths are accurately measured of the arc lines of Rb and Li emitted from a source which produces very sharp well defined lines. In the case of Rb the satellites of the third and fourth members of the diffuse series are found whereby the splitting of the D-level is proved. The structure of the red Li line 6708Å is investigated for different pressures in the source and a somewhat remarkable reversal phenomenon is noticed. It is considered that the red sunspot line appearing at the same wave-length as the Li line 6708Å is probably not a Li line. J. E. K.

4998. Vacuum Arc Spectrum of Zinc. C. W. Hetzler, R. W. Boreman and K. Burns. *Phys. Rev.* 48. *pp.* 656–659, *Oct.* 15, 1935.—Sixty lines in the spectrum of the vacuum zinc arc have been observed in the wave-length range 2178Å to 7799Å. All known solar zinc lines, including two not hitherto listed, are included. A suitable source for obtaining weak lines in vacuum is described. The stronger lines of the following elements were observed: Pb, Cu, Cd, Ag, Sn, Na, K, Rb, Cs, Sr, Be. The observations were made by means of the F and P interferometer, and by various gratings and prisms. AUTHORS.

4999. Extreme Ultra-Violet Spectrum of Selenium. G. Goudet. *J. de Physique et le Radium,* 6. *pp.* 433–438, *Oct.,* 1935.—The spectrum was excited in Se_2 vapour by a h.f. discharge, a few grains of Se being gently heated at the end of the discharge tube, and photographed with a 1m. grazing-incidence vacuum-grating spectrograph. A list of lines from 1294 to 332 Å is given. A little permanganate was introduced into the discharge tube to give oxygen lines which were used as standards, an accuracy of 0·01 Å being claimed. F. S.

5000. Spectrum of Doubly Ionised Zinc. S. Basu. *Indian Journ. Phys.* 9. *pp.* 537–544, *Sept.*, 1935.—The spectrum of doubly ionised zinc is analysed in the region between λ5513 to λ2387. 23 new terms are obtained, mostly derived from the configuration $3d^9\,4d$, and over 100 lines are accounted for. AUTHOR.

5001. Summation Rules in Normal "Forced" Dipole Multiplets. B. Milianczuk. *Acta Physica Polonica*, 4. 1–2. *pp.* 65–71, 1935. *In German.*—It is shown that the summation rules for the intensities of the normal "forced" dipole multiplets are not generally fulfilled. In the special case in which the fine structure separations are small compared with the term differences of the initial, intermediate and end states the summation rules are obeyed. Measurements by Ornstein and Burger of the CdI triplets 2^3P–4^3F and 2^3P–5^3F confirm this special case deduction. On the other hand intensity measurements by Sambursky of the 2^2P–4^2F doublet of CuI deviate more from the summation rule than is to be expected from theory. J. E. K.

5002. Transition Probabilities in Doubly-Excited Helium Atoms. J. Kreisler. *Acta Physica Polonica*, 4. 1–2. *pp.* 151–161, 1935. *In German.*—The following transition probabilities are discussed theoretically:—radiationless transition, transition from the $2s3s\,^3S$ to the $2s2p\,^3P$ state, and from the $2s3s\,^3S$ to the $1snp\,^3P$ state. W. R. A.

5003. Hyperfine Structure in Selenium, Palladium and Gold. L. Sibaiya. *Indian Acad. Sci., Proc.* 2A. *pp.* 313–319, *Sept.*, 1935.—Hyperfine structure analysis of Se and Pd lines shows that none of the levels examined reveal any even isotope displacement. The nuclei of Se 77 and Pd 105 have very small magnetic moments and their spin moment is probably $\frac{1}{2}\cdot h/2\pi$. The doublet structure ($\triangle\nu = 0\cdot224$ cm.$^{-1}$) observed by Ritschl in the resonance lines of Au has been confirmed by the redoubling of each component due to self-reversal in the source; this test proves that the originally observed doublet structure does not arise from self-reversal as the earlier results of Frisch would suggest. While in the isoelectronic spectrum of Hg II the $5d^9\,6s^2\,^2D_{\frac{5}{2}}$ level exhibits isotope displacement, arc lines of Au involving this level point definitely to the existence of a single isotope of mass 197; the accepted chemical atomic weight is therefore considered to be too high. The nuclear spin moment of Au is $\frac{3}{2}\cdot h/2\pi$ and the $g(I)$ factor comes out as 0·136 agreeing with Landé's theoretical value. AUTHOR.

5004. Hyperfine Structure and Nuclear Magnetic Moment of Caesium I. L. P. Granath and R. K. Stranathan. *Phys. Rev.* 48. *pp.* 725–731, *Nov.* 1, 1935.—The hyperfine structure of the lines λλ8761, 4593, 4555, 3889 and 3877 of the arc spectrum of caesium were observed with a Fabry-Perot etalon. The interval factors for the $6^2S_{\frac{1}{2}}$, $6^2P_{\frac{1}{2}}$, $7^2P_{\frac{1}{2}}$, and $8^2P_{\frac{1}{2}}$ states were found to be 0·0767, 0·00925, 0·00329, and 0·0017 cm^{-1} respectively. Assuming a nuclear spin of 7/2, the nuclear magnetic moments calculated from Goudsmit's formulæ were 2·66, 2·38, 2·62 and 3·01 nuclear magnetons for the respective states. AUTHORS.

5005. Nuclear Moments of Lithium, Potassium and Sodium. M. Fox and I. I. Rabi. *Phys. Rev.* 48. *pp.* 746–751, *Nov.* 1, 1935.—The atomic beam method of "zero moments" is applied to the measurement of the nuclear spin and hyperfine structure separation of the normal $^2S_{\frac{1}{2}}$ state of Li^7. The experimental arrangement is such that the precision is about 1 %. It is verified that the nuclear spin is 3/2, and the hyperfine structure separation is measured to be $0 \cdot 0268 \pm 0 \cdot 0003$ cm^{-1}. By using the modified Goudsmit formula the nuclear magnetic moment is calculated to be 3·20 nuclear magnetons compared with the value of 3·28 calculated from hyperfine structure measurements on the $^3P_0 - {}^3S_1$ group (λ5485) of $(Li^7)^+$ by Breit and Doerman using wave functions. The same method applied to K and Na yields hyperfine structure separations of $0 \cdot 0154 \pm 0 \cdot 0002$ and $0 \cdot 0596 \pm 0 \cdot 0006$ cm^{-1} respectively, which lead to nuclear magnetic moments of 0·397 and 2·08 nuclear magnetons. With another arrangement of the apparatus yielding higher resolution than previously obtained it is possible to set the value of 5/2 as an upper limit for the spin of the K^{41} nucleus. With the same arrangement applied to Li it is found that the nuclear spin of Li^6 is 2/2 or greater and that the magnetic moment of the nucleus is of the order of magnitude of that of the deuton. AUTHORS.

5006. Nuclear Spin of Iodine. Part II. Fine Structure in Arc Spectrum and Fine Structure Perturbation Effect. S. Tolansky. *Roy. Soc., Proc.* 152*A*. *pp.* 663–672, *Nov.* 15, 1935.—The fine structures of 13 of the classified lines of the iodine arc spectrum (region λλ 6300–4760) emitted by a water-cooled hollow kathode discharge are measured with a silvered Fabry-Perot interferometer and analysed. The nuclear spin value ($\frac{5}{2}$) previously found in the first spark spectrum is confirmed. The 6*s* $^4P_{\frac{5}{2}}$ term is found to be perturbed by a term with a $J = \frac{3}{2}$ causing a breakdown in the fine structure interval rule. Fine structure interval factors are found for ten terms. The interval factor for 6*s* $^4P_{\frac{5}{2}}$ is 2·17 times that of 6*s* $^4P_{\frac{3}{2}}$, but some of the $5p^4\,7p$ terms have fine structure interval factors greater even than that of 6*s* $^4P_{\frac{5}{2}}$. This shows that the *p* electrons make important contributions to the fine structure coupling factors even in the presence of an *s* electron. [For Part I see Abstract 2107 (1935).] AUTHOR.

5007. Permutation Degeneracy in the Vector Model of the Atom. M. Markov. *Comptes Rendus* (*Doklady*) *de l'Acad. des Sciences, U.S.S.R.* 3. 3. *pp.* 103–104, 1935. *In German.*—It is shown that indentities of the type $2\,\vec{s}_i\,\vec{s}_j = -(\vec{l}_i\,\vec{l}_j)^2 - (\vec{l}_i\,\vec{l}_j) + \frac{1}{2}$ (in which $\vec{s}_i, \vec{s}_j$ are spin moments and $\vec{l}_i, \vec{l}_j$ are orbital moments) deduced by van Vleck for two equivalent electrons on the basis of the Pauli principle [see Abstract 2036 (1934)], arise from general permutation theory and are valid for any equivalent electrons. C. B. A.

5008. Energy Levels of Inert-Gas Configurations. C. L. Bartberger. *Phys. Rev.* 48. *pp.* 682–683, *Oct.* 15, 1935.—The calculation of the energy levels of the inert gases for small values of *n* cannot be done by means of the simplified method used for large *n* values. Full calculations have now been done for various configurations of Ne, A, Kr and Xe. The results are shown graphically. A. H.

5009. Deepest Terms in Ions of the Isoelectronic Sequence A I-Mn VIII. P. G. Kruger and S. G. Weissberg. *Phys. Rev.* 48. *pp.* 659–663, *Oct.* 15, 1935.—Radiations corresponding to the energy differences between the terms $3p^6\,{}^1S_0 - 3p^5\,4s\,{}^3P_1{}^0, {}^1P_1{}^0$ in Ti V, V VI, Cr VII, Mn VIII and $3p^6\,{}^1S_0 - 3p^5\,5s\,{}^3P_1{}^0, {}^1P_1{}^0$ in V VI and Cr VII have been observed. These radiations connect the upper states with the deepest terms in each ion and therefore enable the calculation of the ionisation potentials. The identification of the lines was facilitated by the use of constant second difference displaced frequency diagrams. The limits of the $3p^6\ {}^1S_0 - 3p^5$ ms ${}^3P_1{}^0$, ${}^1P_1{}^0$ series have been calculated for V VI and Cr VII, and have an estimated error in the value of the deepest terms of 0·5%. The values of the deepest terms of V VI and Cr VII, calculated from series limits, make possible the calculation of the absolute value of the deepest terms of Sc IV, Ti V and Mn VIII from a Moseley diagram. AUTHORS.

5010. Deep Terms in the Isoelectronic Sequence V I to Cu VII. P. G. Kruger and Helen T. Gilroy. *Phys. Rev.* 48. *pp.* 720–721, *Nov.* 1, 1935.—By the use of constant second differences in the radiated frequencies from terms involving an electron transition to the ground state, it has been possible to identify the $3d^5\ {}^6S_{5/2}$ and $3d^4\ 4p\ {}^6P^\circ$ terms of this sequence. Ionisation potentials cannot be computed because of the lack of completeness in the data on the first three members of the sequence. [See Abstract 1627 (1932).] AUTHORS.

5011. Theory of Pressure Effects of Foreign Gases on Spectral Lines. H. Margenau. *Phys. Rev.* 48. *pp.* 755–765, *Nov.* 1, 1935.—The chief aim of the considerations presented is to contribute to the understanding of the effects of high pressures of foreign gases upon the shape and the position of a spectral line. A formal distinction is made between statistical and impact distributions, and the former is calculated in closed form for an interaction law of the type $\Delta\nu = -a/r^6$. The distribution is a special case of Pearson's curves. Next the relation between the statistical and the true distribution is examined from a fundamental point of view which illuminates the character of the approximations made in the various theories of pressure broadening. Finally, by the use of a simplified procedure, approximative expressions are developed for the entire intensity distribution within the line, probably valid for pressures around 20 atmospheres. An expression capable of graphical integration, is given which represents the true distribution for lower pressures. The theoretical results are compared with experimental data. Some concrete conclusions: the shift of the maximum is nearly proportional to the pressure of the perturbing gas at low pressure, proportional to its square at high pressures. The transition occurs at a pressure for which the impact half-width $\approx$ the shift of the statistical maximum. (About 20 atmospheres for $K - N_2$, 50 atmospheres for $Hg - N_2$.) At pressures up to $\approx$ 20 atmospheres the impact width determines the shift of the intensity maximum, the latter being at low pressures far greater than the shift of the statistical maximum. Half-widths are also proportional to approximately the first power of the pressure at low, to the second power at high pressures. At pressures up to $\approx$ 10 atmospheres, the half-width is about twice the shift of the maximum. The shift is a function of temperature as well as pressure. AUTHOR.

5012. New Emission Spectrum of Sulphur in the Photographic Infra-Red. M. Désirant and J. Duchesne. *Comptes Rendus,* 201. *pp.* 597–598, *Oct.* 7, 1935.—A band system, attributed to the excitation of S_2, is observed in the spectrum of carefully purified sulphur at the limit of the principal system. The bands, which are degraded towards the violet, extend from 6650 to 7765 Å, and their frequencies can be represented by the formula: $\nu = 13321 + 506v' - 4v'^2 - 328v'' + 2v''^2$. C. B.A.

5013. Induced Predissociation and Energy Exchange in Nitric Oxide. E. Kondratjewa and V. Kondratjew. *Acta Physicochimica,* 3. 1. *pp.* 1–10, 1935. *In English.*—The β-bands of NO in the discharge spectra of NO with the addition of A become more strongly developed in comparison with the γ-bands. This is explained as induced predissociation of the NO′ molecule as a result of collisions with A atoms. A mechanism for this is developed, and it is shown that the probability of the conversion of a vibration quantum of an excited NO molecule into kinetic energy on collision with an A atom is of the order of unity, in agreement with data for other molecules. C. B. A.

5014. Band Emission near Spectral Lines in the Ultra-Violet. F. Duschinsky. *Comptes Rendus,* 201. *pp.* 542–543, *Sept.* 30, 1935.—Rayleigh observed a system of fine bands near the Hg resonance line 2537 Å which were subsequently observed by Hulubei [see Abstract 119 (1932)] in the emission of a mercury arc burning under water. The author observes the same phenomenon not only near the Hg line but also near lines from other sources which are sufficiently narrow and intense. It is proved that the bands do not originate in the source of light, but are apparently a very complicated interference phenomena arising in the lenses and prisms of the spectrograph which in this case was a Schmidt and Haensch instrument with quartz telephotographic objective having a dispersion of 3 Å/mm. at 2537 Å. J. E. K.

5015. Infra-Red Absorption of Aqueous Solutions of Sulphates. Maria Battista. *N. Cimento,* 12. *pp.* 342–347, *June,* 1935.—A study of the modification produced in the absorption bands of water by the action of dissolved salts having the same anion, SO_4. The salts investigated are Cu SO_4, Fe SO_4, and Mn SO_4. The curves connecting absorption and wave-length show the following :—(1) For the first two maxima, corresponding very probably with multiple frequencies of one of the three bands of water about 3μ, there is no displacement but only a constant increase of intensity. (2) For the fundamental band at 3μ there is displacement of the maximum towards the greater wave-lengths, with a maximum of absorption, for the two sulphates of Cu and Fe. (3) The band at $4\cdot6\mu$ behaves similarly to that at 3μ. (4) The aqueous solution of $MnSO_4$ behaves quite differently from the other two, showing a notable diminution of absorption for the two bands at 3μ and $4\cdot6\mu$ with an increase of intensity for the first maximum of the fundamental band of water. J. J. S.

5016. Infra-Red Absorption of Oxygenated Water. A. Maione. *N. Cimento,* 12. *pp.* 358–360, *June,* 1935.—Observations are made with a registering spectrograph of the infra-red absorption spectrum of oxygenated water as far as $5\cdot5\mu$. The oxygenated water contained 36 % by weight of H_2O_2 corresponding to a concentration of 12 gm., mol. of H_2O_2 and 40 gm. mol. of H_2O per l. of solution. Throughout the spectral field studied an increase of absorption is found in accordance with analogous cases in processes of molecular association. There is a profound modification of the band at 3μ, whilst the maxima at $1\cdot5\mu$ and 2μ whose frequencies are multiples of one of the three frequencies of the fundamental band at 3μ, remain practically unchanged. J. J. S.

5017. Infra-Red Absorption Spectra of Amines and Amides. Marie Freymann and P. Rumpf. *Comptes Rendus,* 201. *pp.* 606–608, *Oct.* 7, 1935.—The band near $1\cdot04\mu$ characteristic of tricoordinated N, is absent from $(NH_2)_2\cdot2HCl$ and $NH_2(OH)\cdot HCl$, but appears in aqueous solutions of $(NH_2)_2\cdot HCl$ and $NH_2(OH)$. It is likewise absent from aqueous solutions of glycocoll and taurine, but present in solutions of the Na and Li salt respectively. It is therefore concluded that the neutral solutions contain the amphoteric ions $^+NH_3CH_2CO_2^-$ and

$^{+}NH_3CH_2CH_2SO_3^-$, those of the salts the anions $NH_2CH_2CO^-$ and $NH_2CH_2CH_2SO_3^-$. Similarly as regards *p*-toluenesulphamide. An aqueous solution of urea has a band at 1·008μ, but one of the nitrate none. The exact position of the band depends on the nature of the adjoining groups in the molecule, thus λ is increased by proximity of (OH), reduced by that of (CO). [See Abstract 2110 (1935).] C. A. S.

5018. Infra-Red Spectrum of Heavy Water. E. F. Barker and W. W. Sleator. *J. Chem. Phys.* 3. *pp.* 660–663, *Nov.*, 1935.—Samples of water vapour containing 90 and 40 % of D_2 have been examined in the infra-red, and the absorption bands ν_2 and ν_3 for D_2O and ν_2 and ν_1 for HDO have been located. The position of ν_1 for D_2O is known from Raman scattering. Of the nine fundamental frequencies for the three varieties of water, eight have now been observed. The ninth, ν_3 for HDO, should lie very close to the corresponding band for H_2O and is apparently completely masked. Computed values of these frequencies already available agree very well with the measured ones. A fair degree of resolution is obtained in the bands ν_2. The fine structure observed agrees approximately with that predicted by using the molecular dimensions obtained by Mecke, *viz.*, OH distance $\sim 0\cdot95 \times 10^{-8}$ cm. and apex angle $\sim 105°$. The magnitude of the interactions is so great, however, that precise determinations of these constants must await a more complete solution of the mechanical problem. AUTHORS.

5019. Infra-Red Absorption of Cyanides and Thiocyanates. W. Gordy and D. Williams. *J. Chem. Phys.* 3. *pp.* 664–667, *Nov.*, 1935. —Aqueous solutions of seven inorganic cyanides, two thiocyanates, and one cyanate are studied in the region from 1·2μ to 7·5μ as well as two organic cyanides and an organic thiocyanate. In all the materials a characteristic absorption band is observed in the region from 4·38μ to 4·90μ. The exact position of the band is found to be different for the various substances. This characteristic absorption is attributed to changes in the vibrational energy of the bound CN group. An additional band appearing only in the highly ionised cyanide solutions is attributed to the free CN ions. In the cyanate solution a double band appears in the region of 7μ which is not characteristic of the cyanide or thiocyanate solutions. Hydrolysis and solvation effects are observed in some of the solutions. AUTHORS.

5020. Infra-Red Absorption Spectrum of Methyl Deuteride. N. Ginsburg and E. F. Barker. *J. Chem. Phys.* 3. *pp.* 668–674, *Nov.*, 1935.—The six fundamental vibrational frequencies of methyl deuteride are observed and the fine structure of the bands resolved. The frequencies are $\nu_6 = 1156\cdot3$, $\nu_5 = 1306\cdot8$, $\nu_4 = 1477\cdot1$, $\nu_3 = 2205\cdot25$, $\nu_1 = 2983\cdot0$, $\nu_2 = 3031\cdot0$. From the fine structure of the bands, the moments of inertia are found to be $Ia = 7\cdot166 \times 10^{-40}$ gm., cm^2., $Ic = 5\cdot298 \times 10^{-40}$ gm. cm^2., and the internuclear distances are $C - H = 1\cdot093 \times 10^{-8}$ cm., $H - H = 1\cdot785 \times 10^{-8}$ cm. From the four previously known frequencies of methane and each of the frequencies of this molecule, the values of the five potential constants are computed. Three of the sets are consistent and agree well with the values found by Dennison and Johnston, but the other three sets have either negative or imaginary values. The frequencies from which these are calculated are the ones which take part in a resonance interaction which was not included in the theory. From the observed spacings of the zero branches of the perpendicular bands, extreme ranges of the rotation-vibration interaction factors are computed. An overtone, $2\nu_4 = 2923$, was also observed as were three frequencies of the molecule CH_2D_2, at 1036·0, 1090·5, and 1235·5 cm^{-1}. AUTHORS.

5021. Absorption Spectra of Colloidal Solutions and Metallic Films. A. T. Williams.—*Comptes Rendus,* 201. *pp.* 665–667, *Oct.* 14, 1935.—Results for colloidal solutions of Ag, Au and Pt are discussed. Absorption maximum in the visible depend on the colour of the solution. All the colloids are characterised by an ultra-violet band which appears to be independent of the method of preparation of the colloid. Gamboge solutions (true and colloidal) exhibit very similar spectra. A short discussion of the absorption spectra of metallic films is given. W. R. A.

5022. Absorption Spectrum of Solid Oxygen. Part II. A. Prikhotko and M. Ruhemann. *Phyz. Zeits. d. Sowjetunion,* 8. 3. *pp.* 294–299, 1935. *In English.*—The absorption spectrum of solid α-oxygen was studied between 4000 and 3000 Å. A series of bands is found similar to the two series in the visible region. Preliminary results are given concerning the band system below 2000 Å. [For Part I see Abstract 3484 (1935).] AUTHORS.

5023. Ultra-Violet Absorption Spectrum of Oxygen. L. Herman and Renée Herman. *Comptes Rendus,* 201. *pp.* 714–716, *Oct.* 21, 1935.—The two absorption band systems for O_2 between 2400 and 2800 Å have been observed simultaneously. The relative intensities of the two systems can be reversed by varying the pressure of the gas. An increased number of Herzberg bands have been analysed. W. R. A.

5024. Far Ultra-Violet Absorption Spectrum of Oxygen. W. C. Price and G. Collins. *Phys. Rev.* 48. *pp.* 714–719, *Nov.* 1, 1935.—The far u.v. absorption spectrum of oxygen is photographed under high dispersion in the region 1300–650 Å. The bands are explained as going to the various excited states of O_2^+ as limits and are attributed to the removal of $v\pi$, $w\pi$ and $x\sigma$ electrons, respectively, from the normal state of O_2. The results strongly support Mulliken's assignment of the visible O_2^+ bands to the transition $^4\Sigma_g^- \rightarrow {}^4\Pi_u$. The distances of the $^4\Pi_u$ and $^4\Sigma_g^-$ states of O_2^+ from the ground state of O_2 are given as 16·1 and 18·2 V, respectively, with possible errors of about 0·1 V. The appearance and non-appearance of strong electronic series going to known ionisation potentials are also discussed. AUTHORS.

5025. Absorption of Light by Porphyrins. Part III. A. Stern and H. Wenderlein. *Zeits. f. phys. Chem.* 174. *Abt.A.* 5. *pp.* 321–334, 1935.—The absorption spectra of two chloroporphyrin-e_5-dimethyl esters, which are isomeric but have very different structural formulæ, are described. The presence of a ring between the γ–C atom and the 6-position in the ester prepared with alcoholic HCl is shown by comparison of the absorption curve with that of rhodoporphyrin-XV-dimethyl ester. The absorption of a further porphyrin with an iso-cyclic ring substituted in the β-position is only slightly displaced towards the blue from that of a porphyrin with ethyl substituted in the β-position. Derivatives of the chlorophyl-*b* series are examined. They show regularities similar to those of the *a*-series. The influence on the absorption of the hydration of the vinyl group in the 2-position in both *a*- and *b*-series is studied. [For Part II see Abstract 4588 (1935).] C. B. A.

5026. Temperature Dependence of the CH_3I Absorption Spectrum in the Quartz-Ultra-Violet. A. Henrici and H. Grieneisen. *Zeits. f. phys. Chem.* 30. *Abt.B.* 1. *pp.* 1–39, 1935.—The dependence on temperature of the absorption spectrum of CH_3I vapour is investigated

with large resolution in the extreme quartz ultra-violet. A large number of new bands is discovered especially at the higher temperatures. Many of the bands are interpreted by means of the fundamental vibrations 525, 880 and 1237 cm^{-1}. and the corresponding vibrations 508, 780, 1090 and 1250 cm^{-1}. in the excited electron state. The principal bands are characterised by an exceptional broadening with increasing pressure. The apparent broadening of some other bands is caused by an underlying continuum which is presumably an unresolved rotation fine structure. The unusual behaviour of some bands with increase of temperature is noteworthy and makes it seem probable that they belong to new electron term transitions which are strongly dependent on temperature. The fundamental vibrations are in this case changed to 495, 805 and 985 cm^{-1}.
J. E. K.

5027. Absorption Spectra of Substituted Benzenes. E. Steurer. *Zeits. f. phys. Chem.* 30. *Abt.B.* 2–3. *pp.* 157–158, 1935.—Absorption spectra of pseudocumol, mesitylene, and *p*-xylene are recorded and compared with those obtained by Billroth. [See Abstract 3514 (1935).]
C. B. A.

5028. Absorption Spectrum, Fluorescence and Photochemical Decomposition of Acraldehyde. H. W. Thompson and J. W. Linnett. *Chem. Soc., J. pp.* 1452–1459, *Oct.*, 1935.—The absorption spectrum of acraldehyde vapour is measured over the range 2000–7000 Å. Two regions of absorption are detected, (*a*) from *ca.* 3800 to *ca.* 2900 Å, and (*b*) from 2320 Å to shorter wave-lengths. Region (*a*) is attributable to electronic absorption by the carbonyl group. A preliminary analysis of the band system (*a*) is made. An attempt to excite fluorescence of acraldehyde vapour by irradiation with u.v. light corresponding to the first region of absorption was unsuccessful. The photochemical decomposition and polymerisation are studied with light of wave-length 3665 Å and 3135 Å. The quantum efficiency of each rises in passing from longer to shorter wave-length, but that of the decomposition is surprisingly low. The facts are discussed in relation to current photochemical theory. The possibility of internal degradation or delocalisation of energy in the molecule is discussed.
AUTHORS.

5029. Absorption Spectrum of Selenium Hydride. L. and E. Bloch and Choong Shin-Piaw. *Comptes Rendus*, 201. *pp.* 654–655, *Oct.* 14, 1935.—A new set of bands is observed, the maximum of absorption being near λ2700. As the temperature is raised the absorption becomes total, as observed earlier by other workers. For this band system estimates are made for ω' and ω'' as being 250 cm^{-1}. and 650 cm^{-1}. respectively, this latter being probably the frequency of vibration for the normal state of the molecule. The only periodicity found in the already known visible system is one of 200 cm^{-1}.
A. H.

5030. Absorption Spectrum of TeBr$_2$ Vapour. J. Larionov. *Acta Physicochimica*, 2. 1. *pp.* 67–80, 1935. *In English.*—The absorption spectrum of TeBr$_2$ vapour was photographed in the visible and u.v. using prism and grating spectrographs. A band spectrum consisting of diffuse bands devoid of heads, together with a superimposed continuous absorption was found in the visible; and another continuous spectrum in the u.v. Measurements of the bands are given. The continuous maxima are compared with thermochemical data and the corresponding dissociations are discussed.
F. S.

5031. Absorption Spectrum of SnI_4 Vapour. A. W. Banow. *Acta Physicochimica*, 2. 6. *pp.* 733–736, 1935. *In German.*—Three maxima are observed in the continuous absorption of SnI_4 vapour at 3570, 2800 and 2450 Å. It is established that the first and second maxima correspond to photo-dissociation of the SnI_4 molecule into SnI_3 and I or I′ respectively. The energy of dissociation in the former case has been fixed at about 2·6 V. F. S.

5032. Absorption Spectrum of $TeCl_2$ Vapour. J. Larionov. *Acta Physicochimica*, 3. 1. *pp.* 11–22, 1935. *In English.*—The absorption spectrum of $TeCl_2$ vapour at temperatures from 155° to 215° C., examined in rather low dispersion, consists of a large number of headless diffuse bands and two continua. The bands appear to form four sets of sequences: *A* λλ7434–6099, *B* λλ6066–5616, *C* λλ5598–4947, *D* λλ4926–4346. Each set is described in some detail and rough measurements of the wave-lengths of the middles of the bands are tabulated. The intervals (in cm^{-1}.) between successive bands in sequences are roughly 268 to 250 in *A*, 309 in *C*, and 299 to 295 in *D*, which may be a continuation of *C*. The first continuum is superposed on the bands in *C* and *D* and is ascribed to the process $TeCl_2 + h\nu \rightarrow TeCl + Cl$ or Cl′. The second continuum is in the ultra-violet and is ascribed to $TeCl_2 + h\nu \rightarrow Te + 2Cl$. The heats of dissociation are given (in k.cal.) as $D_{\mathrm{Te}+\mathrm{Cl}_2} = 51$, $D_{\mathrm{TeCl}+\mathrm{Cl}} = 54$, $D_{\mathrm{TeCl}+\mathrm{Cl}'} = 56$, $D_{\mathrm{Te}+2\mathrm{Cl}} = 108$. W. J.

5033. Ultra-Violet Absorption Spectra of Complex Aromatic Hydrocarbons. Part I. W. V. Mayneord and E. M. F. Roe. *Roy. Soc., Proc.* 152*A*. *pp.* 299–324, *Nov.* 1, 1935.—The u.v. absorption spectra of ethyl alcohol solutions of a number of aromatic hydrocarbons, some of which are of biological importance, are investigated. The compounds examined include benzene, naphthalene, anthracene, 1 : 2-benzanthracene, 1 : 2 : 5 : 6-dibenzanthracene, phenanthrene, and their derivatives, as well as chrysene, picene, pyrene and its derivatives. Details are given of the experimental methods and some discussion of possible errors. The spectra of chemically related compounds are compared and general resemblances between them are pointed out. In general no adequate theoretical discussion of the absorption spectra of these compounds is possible, but the effects of the addition of various groups have been noticed. Preliminary references are made to changes observed in the absorption spectra on cooling the solutions to approximately − 183° C. Some theoretical considerations of the subject are mentioned. AUTHORS.

5034. Rotational Structure of the C Band of Calcium Deuteride. B. Grundström. *Zeits. f. Physik*, 97. 3–4. *pp.* 171–176, *Oct.* 11, 1935.—The 0,0 band of CaD, $c^2\Sigma \rightarrow x^2\Sigma$, near λ3530, investigated by Watson [see Abstract 750 (1935)], shows very large perturbations and a break-off at $K' = 18$. Watson observed the lines as single (dispersion = 2·2 Å/mm.) and, with help of combination differences from $B^2\Sigma \rightarrow X^2\Sigma$ bands, arrived at the correct *K* numeration. With higher dispersion, 0·95 Å/mm., the author observes spin doubling and further examines perturbations. The latter reach maxima at $K' = 3$, 11 and 14, and are due, as in the corresponding CaH band [see Abstract 3876 (1935)], to state $D^2\Sigma$, which also causes the predissociation at $K' = 18$. Each line with $K' = 1$–9, 12, and 16–18 appears single, and each one with $K' = 10$, 11 and 13–15 as a spin doublet. The doublets with $K' = 11$ and 14 are so violently perturbed that each has two components of diminished intensities in two widely different regions of the band. *B*-values cannot be derived from data for the band in emission, but it is hoped to obtain absorption data for this purpose. W. J.

5035. Beryllium Deuteride Spectra. P. G. Koontz. *Phys. Rev.* 48. *pp.* 707–713, *Nov.* 1, 1935.—The spectra of the BeD green bands and of the u.v. BeD^+ bands are photographed at high dispersion. A Be arc in a deuterium atmosphere was the source. Rotational analyses of the BeD bands, and rotational and vibrational analyses of the BeD^+ bands are presented. The electronic isotope shift in the u.v. system is $0\cdot8$ cm^{-1}. The values $B_e{}^* = 5\cdot6807$ for the lower state of BeD and $B_e{}^* = 5\cdot9546$ for the lower state of BeD^+ are found. Comparison of these values with the corresponding values of the hydrides gives ratios $0\cdot55110$ and $0\cdot55073$ respectively, whereas $\rho^2 = 0\cdot55060$. Calculation of the J. L. Dunham corrections to B_e for the anharmonic oscillator are shown to affect the B_e ratio inappreciably. The variation of the ratio of the $B_e{}^*$'s from ρ^2 and the small electronic isotope shift are briefly discussed. AUTHOR.

5036. *E* Band System of Calcium Hydride. W. W. Watson and R. L. Weber. *Phys. Rev.* 48. *pp.* 732–733, *Nov.* 1, 1935.—The E band system of CaH at 4900 Å is shown to be the $\Delta v = 0$ sequence of a $^2\Pi \rightarrow {}^2\Sigma$ transition, the lower state being the normal $^2\Sigma^+$ state. Quantum analysis gives for the $E,{}^2\Pi$ state $B_0 = 4\cdot2844$, $D_0 = -2\cdot16 \times 10^{-4}$, $A = 9\cdot3$, $\gamma = +0\cdot230$ for $K < 20$, $\omega_0 = 1248\cdot6$ and $\omega_e x_e = 21\cdot8$. The large γ-constant, its changing value for the higher rotational levels and other relations are indications of strong interaction between the E state and other near-lying CaH states. Spin- and Λ-doubling relations are discussed. AUTHORS.

5037. Potential Energy Curves and Structure of the Alkaline Earth Oxides. P. C. Mahanti. *Indian Journ. Phys.* 9. *pp.* 517–536, *Sept.*, 1935.—The potential energy curves for the different electronic states of the alkaline earth oxides are drawn after Morse. The electronic configuration, dissociation energy and the products of dissociation in each state are discussed and the similarities in the spectra of the different members traced as far as possible. In the ground state of the alkaline earth oxides, the metal atom is supposed to be in an excited ^3P state with outermost electrons in a $s\ p$ configuration and the oxygen atom in its normal ^3P state with p^4-configuration, the linkage in the molecule being due to a $p\ p$-type of binding between the constituent atoms. AUTHOR.

5038. Interpretation of the Vibration Spectrum of Organic Molecules with the Help of the Isotope Effect. E. Bartholomé and H. Sachsse. *Zeits. f. phys. Chem.* 30. *Abt.B.*1. *pp.* 40–52, *Sept.*, 1935.—It is shown that, even in those cases in which the isotope effect cannot be quantitatively evaluated, valuable aid to the determination of normal vibrations can be obtained from observation of its qualitative behaviour. With the assistance of the results of the isotope effect the fundamental frequencies of methyl alcohol are established and some outstanding difficulties in the interpretation of the ethane spectrum are cleared up. J. E. K.

5039. Vibration Frequencies of Acrylic Acid Nitrile and of Ethylene Oxide. B. Timm and R. Mecke. *Zeits. f. Physik*, 97. 3–4. *pp.* 221–224, *Oct.* 11, 1935.—The Raman spectra of C_2H_3CN and of C_2H_4O were investigated, following up the author's work on acetylene [see Abstract 2587 (1935)]. A. C. M.

5040. Vibration Spectrum of Benzene. K. W. F. Kohlrausch. *Zeits. f. phys. Chem.* 30. *Abt.B.* 4. *pp.* 305–315, 1935.—C_6H_6 and

C_6D_6 are treated as valence-force systems of symmetry D_6^h and five of the six force-constants necessary for stability are calculated. The constants are nearly alike, and allow the calculation of sixteen of the twenty possible fundamental frequencies. The numerical calculated values and the selection rules are in good agreement with observation. Pyridine is also considered, and it is concluded that in this ring also the effective forces round the ring are the same. A. C. M.

5041. Ground State of (H_2), the Molecular Ion (H_2 +) and Wave Mechanics. O. W. Richardson. *Roy. Soc., Proc.* 152*A*. *pp.* 503–514, *Nov.* 15, 1935.—This paper consists of two parts. The first part is a critical discussion of the agreement between the values of the fundamental constants, such as the dissociation energy, of the ground state of the hydrogen molecule (1) as determined by observations, and (2) as calculated by wave mechanics. The second part is a comparison of the properties of the molecular ion (H_2 +) (1) as predicted empirically from a comparative study of various excited states of (H_2) and (2) as predicted by wave mechanics. AUTHOR.

5042. Reproducibility of Relative Energy Distribution of the Continuous H_2-Spectrum. V. E. Gonsalves. *Physica*, 2. *pp.* 1003–1015, *Nov.*, 1935. *In English.*—The purpose of the present research is in the first place to ascertain whether it is possible to use the relative energy distribution of the continuous spectrum of hydrogen, emitted by a H_2-discharge-tube, as a standard relative energy distribution for researches in the u.v. A description is given of experiments showing the dependence of the relative energy distribution on the pressure of the hydrogen in the tube and the current. AUTHOR.

5043. Absorption Spectra and Dissociation of Trivalent Halides. S. Kato and F. Somens. *Inst. Phys. and Chem. Research, Tokyo, Sci. Papers, No.* 606. *pp.* 95–111, *Oct.*, 1935. *In English.*—Absorption spectra (7000–2000 Å) of the trivalent halides, $AsCl_3$, $AsBr_3$, AsI_3, $SbCl_3$, $SbBr_3$, SbI_3, $BiCl_3$, $BiBr_3$, BiI_3, $FeCl_3$, $FeBr_3$, $TlCl_3$ and $TlBr_3$ dissolved in ether are investigated and the photo-dissociation of each of the salts studied. The electronic states of the molecules in ether and the dissociation products in various electronic excited states are given tentatively. In order to ascertain the effect of the solvent used upon the molecular state of the salts a study is made of the absorption frequencies of the same salts in the vapour state as well as of the Raman frequencies of the ether solutions. It is concluded that the ground state of the molecules in ether is the deepest energy state of the normal molecule although the molecules are somewhat deformed by the solvent. A. H.

5044. Ultra-Violet Resonance Series of Sodium. A. Seidel. *Phys. Zeits. d. Sowjetunion*, 8. 2. *pp.* 204–205. 1935. *In English.*—The fluorescence spectra excited by Ag, Cu and Zn sparks in Na vapour at 500–550° C. are very briefly described. D. H. F.

5045. Ultra-Violet Fluorescence Spectrum of Iodine Vapour. Influence of Foreign Gases. F. Duschinsky and P. Pringsheim. *Physica*, 2. *pp.* 923–932, *Nov.*, 1935. *In German.*—The intense band at 3400 Å brought out in I_2 vapour fluorescence by N_2 addition (Oldenberg) is here studied further, and the effect of rare gases in place of nitrogen is investigated. The band referred to is seen on additions of He and He-Ne mixtures, but not so clearly distinguished from background and not so well structured. At temperatures above 700° C. and low pressures of iodine addition of N_2 gives exactly the same form of band as obtained at room-temperatures with He addition. Presence of traces of Hg gives the same band as a sensitised fluorescence effect, and at the same time HgI bands. A consideration of energy relations indicates the necessity of a modification of the accepted states of the I_2 molecule, if the Oldenberg band is to be explained as a "transition" band. In an added note the HgI band at 4400 Å is analysed briefly. J. E.

***5046. Measurement of Paschen-Back Effect. P. Jacquinot and T. Belling.** *Comptes Rendus,* 201. *pp.* 778–779, *Oct.* 28, 1935.—The large electromagnet of the Academy of Sciences has been furnished with new pole pieces. With a current of 4000A the power absorbed is 1300 kW and the field produced is 65,800 gauss. The yellow lines of Hg have been investigated and previous results confirmed, but there is a certain divergence from Houston's calculations. F. S.

***5047. Effect on Helium Lines of Perpendicular Electric and Magnetic Fields. W. Steubing and W. Redepenning.** *Ann. d. Physik,* 24. 2. *pp.* 161–182, *Oct.,* 1935.—A special discharge tube is described in which electric and magnetic fields can be applied at right angles to one another and to the line of sight, the electromagnet being also of special design. A 3-m. concave grating in Eagle mounting was used to photograph the effect. The behaviour of various lines of both ortho- and par-helium is discussed and reproductions given of the combined effect and the appearance with each field by itself. F. S.

5048. Influence of an Electric Field on the Absorption Spectrum of Sodium. Ny Tsi-Ze and Weng Wen-Po. *Comptes Rendus,* 201. *pp.* 716–718, *Oct.* 21, 1935.—The results of Segré [see Abstract 3749 (1934)] have been confirmed and completed quantitatively. [See also Abstract 3065 (1935).] W. R. A.

5049. Bibliography of the Raman Effect. S. C. Sirkar and D. Chakravarty. *Indian Journ. Phys.* 9. *pp.* 553–622, *Sept.,* 1935.—This bibliography is a continuation of the previous one [see Abstract 1908 (1933)] published in 1932. A few papers published in 1931 and overlooked, are now included. A substance index is given, with inorganic substances arranged alphabetically and organic ones according to the International Critical Tables classification. A. C. M.

5050. Raman Spectrum of Phosphorus. C. S. Venkateswaran. *Indian Acad. Sci., Proc.* 2*A. pp.* 260–264, *Sept.,* 1935.—The Raman spectrum of yellow phosphorus as vapour, liquid, solid, and solution in CS_2 has been obtained. Only small changes in frequency are observed while passing from solid to liquid and to vapour, indicating the non-polar character of the molecule. The spectrum of CS_2 is rendered weak, although the spectrum of phosphorus in solution comes out strongly. A strong fluorescent band extending from 6230 to 6550 Å has also been recorded in all cases. AUTHOR.

5051. Raman Spectrum of Deuterium. Part I. S. Bhagavantam. *Indian Acad. Sci., Proc.* 2*A. pp.* 303–309, *Sept.,* 1935.—The paper describes the Raman spectrum of D_2 at a pressure of about 17 atmospheres using λ 4358 of Hg as incident radiation. Rotation lines having frequency shifts $\pm 179 \cdot 5$, $\pm 297 \cdot 4$, $415 \cdot 2$, $530 \cdot 8$ and $643 \cdot 5$ and a vibration line with a shift of $2992 \cdot 7$ are observed. These shifts agree with and confirm the molecular constants given by Urey and Teal for D_2. The relative intensities of the rotation lines agree with the fact that the D nucleus has a spin, of one unit and obeys the Bose-Einstein statistics.

States characterised by even rotational quantum numbers are given a statistical weight twice as large as those having odd rotational quantum numbers. The intensity distribution is in qualitative agreement with that predicted by Manneback's theory for the rotational Raman scattering in diatomic molecules. AUTHOR.

5052. Raman Spectrum of Hydrogen Deuteride. S. Bhagavantam. *Indian Acad. Sci., Proc.* 2*A. pp.* 310–312, *Sept.*, 1935.—Using λ4358 as the exciting radiation, frequency shifts of 267, 442 and 618 arising respectively from the rotational transitions 0 → 2, 1 → 3 and 2 → 4 are recorded in the Raman spectrum of HD gas. The figures compare well with 266·5, 442·1 and 614·8 which are calculated on the basis of the molecular constants given by Urey and Teal for HD. The anti-Stokes line arising from the transition 2 → 0 is also recorded. The phenomenon of alternating intensities is not observed, and the line corresponding to 1 → 3 is the most intense in the series as may be expected. AUTHOR.

5053. Raman Spectrum of Heavy Water. E. Bauer and M. Magat. *Comptes Rendus*, 201. *pp.* 667–669, *Oct.*, 14, 1935.—The spectrum of 98·4 % D_2O in water is discussed. In addition to the stronger Raman lines reported already at 2509, 2389, and 1207 cm^{-1}., three new lines at 170, 350, and 500 cm^{-1}. are reported. These lines are very diffuse and faint. The line at 170 cm^{-1}. is also found unchanged in value in H_2O. Possible origins are discussed. W. R. A.

5054. Raman Spectrum of Heavy Water. R. Ananthakrishnan. *Indian Acad. Sci., Proc.* 2*A. pp.* 291–302, *Sept.*, 1935.—The Raman spectrum of D_2O photographed with a Hilger two-prism spectrograph shows a strong band with three imperfectly resolved components whose frequency shifts are 2363, 2515 and 2662 cm^{-1}. Besides, a sharp band with a frequency shift of 1235 cm^{-1}. with a feeble companion at about 1110 cm^{-1}. is recorded, and a strong low frequency band $\Delta\nu = 175$ cm^{-1}. The triple structure of the principal band, as well as the existence of the other two bands, are noticed for the first time. A comparative study of the Raman spectra of H_2O and D_2O is made and many points of similarity are noticed. Purely from Raman data, it is shown that the valency angles and force constants do not alter much from H_2O to D_2O. It is pointed out that the triple structure of the principal band is probably due to the fact that D_2O is also polymerised similarly to H_2O. The l.f. band appears to be intimately connected with the nature of the liquid state. AUTHOR.

5055. Raman and Infra-Red Spectra of Water. K. Basu. *Indian Phys. Math., J.* 6. *pp.* 55–64, *Sept.*, 1935.—Following up earlier work [see Abstract 3587 (1933)] on the calculation of an energy value formula. a calculation is made, on the basis of the triangular (Debye) model, of the wave-numbers of the lines to be expected in the rotation-vibration spectra of the H_2O molecule. Fair agreement is found with the experimental results. A. H.

5056. Raman Spectra of Isoprene, Dipentene and Ocimene. P. S. Srinivasan. *Indian Acad. Sci., Proc.* 2*A. pp.* 105–112, *Aug.*, 1935. —A number of lines are found for each of these substances, only the first of which has previously been examined. The frequencies are discussed, with a view to checking what types of bands and radicals are present, and the relation to the infra-red absorption spectra is discussed. A. C. M.

5057. Raman Spectra of Iodic Acid and Alkaline Iodates. C. S. Venkateswaran. *Indian Acad. Sci., Proc.* 2*A. pp.* 119–132, *Aug.*, 1935.—The Raman spectrum of iodic acid as a function of concentration has been investigated. The crystal gives five strong lines and a number of weak, sharp lines, which are replaced by intense and broad bands in solution. Evidence is obtained of the progressive dissociation of the acid, and results show that the dissociation is incomplete even at concentrations of 0·5 *N*. Appreciable polymerisation is believed to occur, and to decrease with dilution. The alkaline iodates have also been examined. The main parallel vibrations of the IO_3' ion are split up into components in all the iodates and in iodic acid; four components for γ_1 and two or three for γ_2 are found. Some low-frequency oscillations have also been observed. A. C. M.

5058. Raman Spectrum of N_2O_5. J. Chédin. *Comptes Rendus*, 201. *pp*. 552–554, *Sept*. 30, 1935.—In previous work [see Abstract 2588 (1935)] frequencies of 1045 and 1398 cm^{-1}. were attributed to N_2O_5. Where increasingly large quantities of N_2O_5 are dissolved in HNO_3, a third frequency 1110 cm^{-1}. appears, feebly. Solutions of N_2O_5 in $CHCl_3$ and CCl_4, cooled, have been investigated. Frequencies not belonging to the solvents were found—860, 1033, 1110, 1240, 1335 cm^{-1}. The last frequency was particularly sharp. It is concluded that the N_2O_5 molecule has a different shape when in organic solutions. A. C. M.

5059. Raman Spectrum of Arsenic Trichloride. A. M. Sack and A. E. Brodsky. *Acta Physiochimica*, 2. 2. *pp*. 215–220, 1935. *In German*.—The Raman frequencies of AsA_3 (372 and 410 cm^{-1}.) are greatly reduced when it is dissolved in methyl and ethyl alcohols. The frequencies of the two solvents hardly alter. It is concluded that this is because both the solvents and the $AsCl_3$ have dipole moments, but the binding forces in AsA_3 are relatively weak, and so much the greatest disturbance is effected here. A. C. M.

5060. Raman Spectrum of Tetraethyl-Ammonium Iodide. J. K. Syrkin and M. W. Wolkenstein. *Acta Physicochimca*, 2. 3. *pp*. 303–307, 1935. *In German*.—The Raman spectrum is observed for $(C_2H_5)_4NI$, and it is compared with those of C_2H_5I and $(C_2H_5)_3N$, and conclusions are drawn as to the structure of the molecule of $(C_2H_5)_4NI$. A. C. M.

5061. Raman Effect in H_2SiF_6. J. K. Syrkin and M. W. Wolkenstein. *Acta Physicochimica*, 2. 3. *pp*. 308–312, 1935. *In German*.—One line was observed for this substance at 649 cm^{-1}. This frequency is regarded as the breathing frequency of a symmetrical SiF_6'' ion, and an attempt is made to calculate the frequency on the basis of simple assumptions. A. C. M.

5062. Raman Spectra of Cis- and Trans-Decalines. S. K. K. Jatkar. *Indian Journ. Phys*. 9. *pp*. 545–551, *Sept*., 1935.—Cyclohexane may exist in two forms, "chair" and "cradle" forms. It does not show this isomerism. The cyclohexane ring in decaline cannot be planar, since a model cannot be formed from two plane cyclohexane rings. Two forms can be constructed from tetrahedral models, the *trans*-form with cubic symmetry and the *cis*-form with hexagonal symmetry. Samples were prepared, one containing mainly the *trans*-form, and the other containing considerably more of the *cis*-form. The following shifts are attributed to the *cis*-form: 539, 595, 794, 1040, 1270, 1347 cm^{-1}., and to the *trans*-form: 495, 881, 957, 996, 1145, 1234, 1363 all in cm^{-1}. It is pointed out that the smaller number of short shifts in the *trans*-case is due to the greater symmetry. A. C. M.

5063. Raman Spectra of Dioxane and Tetralin. C. S. Venkateswaran. *Indian Acad. Sci., Proc*. 2*A*. *pp*. 279–290, *Sept*., 1935.—The

Raman spectra of dioxane and tetralin are obtained using the filter technique. The spectrum of dioxane consists of 24 lines of which 14 are reported for the first time and resembles closely that of cyclohexane. Tetralin also gives eleven new lines. The results are discussed with reference to the structure of the molecules. AUTHOR.

5064. Raman Effect in Fuming Sulphuric Acid. J. Chédin. *Comptes Rendus*, 201. *pp.* 724–726, *Oct.* 21, 1935.—The Raman spectra have been observed for different concentrations of SO_3 dissolved in H_2SO_4 from 68 % SO_3 down to 0%. The spectra of the solutions containing a high percentage of SO_3 have no lines in common with those of pure H_2SO_4. It is suggested that in these high concentrations $S_2O_7H_2$ is formed. A. C. M.

5065. Raman Effect in Mixtures of PCl_3 and PBr_3. O. Burkard. *Zeits. f. phys. Chem.* 30. *Abt.B.* 4. *pp.* 298–304, 1935.—The Raman spectra of ten different mixtures of PCl_3 and PBr_3 were photometered. As the concentration of PCl_3 falls, its valence frequencies get smaller, while the opposite is true for PBr_3. The intensity-change of a line attributed to the mixed molecule PCl_2Br was examined, and found to have a maximum intensity in the mixture 6 parts PCl_3 + 3 parts PBr_3. A. C. M.

5066. Effect of Intermolecular Forces on Raman Effect of Liquids. W. Buchheim. *Phys. Zeits.* 36. *pp.* 694–711, *Nov.* 1, 1935.—The effect of an electric field on Raman scattering is investigated theoretically for the case of homgeneous fields. It is concluded (1) that lines should broaden as the field increases, and this should be most marked for vibrations connected with a second order change in the dipole-moment of the molecule; (2) that lines should experience a slight change in frequency, to a less extent than the broadening; and (3) that lines ordinarily forbidden on account of symmetry properties of the molecule may appear. The fields arising in liquids possessing dipole-moments, or in electrolytes, are sufficiently great to expect a noticeable effect of this kind. Observations made in benzene, carbon tetrachloride, and chloroform mixed with various liquids bear out the conclusions. A. C. M.

5067. Intensity and Polarisation of Raman Lines in Liquids. A. V. Rao. *Zeits. f. Physik*, 97. 3–4. *pp.* 154–157, *Oct.* 11, 1935.—Using a narrow slit, the relative intensities and states of polarisation of the Q-branches of various Raman lines in C_6H_6, CCl_4, $CHCl_3$, and $AsCl_3$ have been studied. The total intensity of the depolarised Raman lines makes an important contribution to the depolarisation of the total scattering. C. B. A.

5068. Polarisation of Raman Scattering. F. Heidenreich *Zeits. f. Physik*, 97. 5–6. *pp.* 277–299, *Oct.* 18, 1935.—The state of polarisation of the Raman lines of some organic substances is qualitatively determined by the use of circularly polarised primary light. Experimental proof of Placzek's theory of the Raman scattering, which gives the relations between the linear and circular polarisation, is obtained by quantitative measurement of the condition of polarisation of the Raman lines by the circular polarisation method. By this method the widening of the Rayleigh lines observed in Raman spectra was examined and the polarisation of the widening is quantitatively investigated. The cause of the widening is discussed. The occurrence of "rotation-oscillation Raman bands" in liquids with small moment of inertia was observed through determination of the state of polarisation. A dispersion of the polarisation of the Raman lines in the visible region of the spectrum found by Sirkar is disproved by experiment. J. J. S.

5069. Raman Spectra of Oxalic Acid. J. H. Hibben. *J. Chem. Phys.* 3. *pp.* 675–679, *Nov.*, 1935.—The Raman spectra of anhydrous oxalic acid, its aqueous and alcoholic solutions, and oxalic acid dihydrate were determined. The spectra from the aqueous solution and anhydrous oxalic acid show that the two carboxyl groups do not behave identically. Peculiarities in the spectrum of the dihydrate are indicated. In the alcoholic solution both carboxyl groups behave similarly. The magnitude of the force constants in the carbonyl groups are consistent with the strength of this acid. Various explanations of these anomalies are discussed briefly. AUTHOR.

5070. Discontinuous Molecular Spectra. Part I. R. Frerichs. *Die Physik*, 3. 4. *pp.* 179–192, 1935.—A review of band-spectrum investigations published in the last three years, ending early 1935. It consists of brief notes under sectional headings: progress in experimental methods, quantitative spectrographic analysis of gas mixtures, rotation bands, vibration bands, electronic bands in emission and in absorption, isotope effect, hyperfine structure of band lines and nuclear spin, predissociation, diffuse bands, Zeeman and Stark effects, perturbations, temperature and intensity-distribution, fluorescence ("resonance") spectra, band spectra in cosmic light-sources and in the earth's atmosphere. W. J.

5071. Nature of Luminous Streamers from the Condensed Spark in Vacuo. C. F. Bareford. *Phil. Mag.* 20. *pp.* 825–834. *Nov.*, 1935.—It is found that in the condensed spark in a high vacuum sharply defined luminous streamers can be obtained passing through a hole bored in one of the electrodes and extending into the exhausted space beyond it. The spectra of the streamers show the lines due to neutral and to ionised atoms of the metal of the electrode opposite to the hole. The streamers occur in both the positive and the negative phases of the oscillating current of the spark. The nature of the carriers has not been conclusively determined, but there is some reason to infer that aggregates rather than single atoms are concerned in the formation of the streamers. AUTHOR.

See also Abstracts 4766, 4777, 4778, 4902, 4920, 4964, 4965, 4989, 5101, 5118, 5155.

VELOCITY OF LIGHT.

See Abstract 4866.

VISION.

See Abstract 4952.

X-RAYS.

5072. Kinetic Interpretation of the Colouring of Glass by X-Rays. R. Livingston and C. E. Nurnberger. *J. Phys. Chem.* 39. *pp.* 1011–1019, *Oct.*, 1935.—Some experiments are performed on the rate of colouring of pyrex glass by irradiation with hard X-rays, and on the distribution of relative absorption, of the coloured glass, as a function of wave-length for visible light. A simple hypothesis of the rate of colouring is suggested, an equation is derived from this hypothesis, and it is shown that the experimental measurements are in agreement with the equation. Some discussion of the analogous effects of radiations from radium is included. AUTHORS.

5073. Absorption of Monochromatic X-Ray Beams. J. Read. *Roy. Soc., Proc.* 152*A*. *pp*. 402–417, *Nov*. 1, 1935.—An experiment is described by which the absorption coefficients of monochromatic X-ray beams in the wave-length region 50 to 20 X.U. in lead, tin, copper and iron are measured. A curve relating the absorption coefficient of lead and the wave-length, accurate to 2 %, is obtained. From it the photo-electric absorption coefficients are calculated, and they are from 20 to 7 % greater than corresponding values obtained from the empirical law of Gray. They may be linked up with Allen's value of 41·7 cm^{-1}. at 102 X. U. by the law ; τ cm^{-1}. $= 0{\cdot}01377\,\lambda + 0{\cdot}0003326\,\lambda^2 + 0{\cdot}00003474\,\lambda^3$, where λ is expressed in X units. It is shown that the law $\tau_e \propto Z^3$ holds very closely for lead, copper, and iron, but lead and tin are related more nearly by $\tau_e \propto Z^{3{\cdot}5}$. AUTHOR.

5074. Breadth of the K*α*-Lines of Krypton and of Elements in Chemical Combinations. E. Wilhelmy. *Zeits. f. Physik*, 97. 5–6. *pp*. 312–320, *Oct*. 18, 1935.—By means of excitation by kathode rays and analysis in a double crystal spectrometer the breadth of the K*α*-lines of Kr, Rb (RbCl), Br (KBr) and Cu (Cu, CuO and CuF) were measured. The values for Kr lie on the curve which can be set out from the data measured by Allison for elements between Z = 26 and Z = 47. Here there is thus no perceptible influence of the aggregate condition on the breadth of line. On the contrary the values of Rb and Br, and also of CuF_2, lie considerably above the curve and so manifest an influence of the chemical binding on the line breadth. J. J. S.

5075. L-Emission Spectrum of Platinum. Yvette Cauchois. *Comptes Rendus*, 201. *pp*. 598–600, *Oct*. 7, 1935.—The L-emission spectrum of Pt is photographed under high dispersion and the wave-lengths of the lines are tabulated and compared with the results of other workers. Values are given for several levels, and a number of " forbidden " transitions are reported. [See following Abstract.] C. B. A.

5076. L*α*-Emission Spectra of Mercury, Platinum and Tungsten. Yvette Cauchois. *Comptes Rendus*, 201. *pp*. 721–722, *Oct*. 21, 1935.—Satellite lines in the emission spectra of W(74), Pt(78), and Hg(80) are described and discussed. [See preceding Abstract.] C. B. A.

5077. Relative Energy of the L*α* Satellites Excited by Kathode Rays in the Atomic Number Range 47 to 52. F. R. Hirsh, Jr. *Phys. Rev*. 48. *pp*. 722–724, *Nov*. 1, 1935.—By a photographic method, the measurement of the integrated relative energy of the L*α* satellites, with respect to their parent $L\alpha_1$ line, is extended from Ag(47) to Te(52). In this range the satellites decrease rapidly in relative energy with increasing atomic number. This is in substantial agreement with the new theory of Coster and Kronig [see Abstract 1693 (1935)]. AUTHOR.

5078. Fine Structure of the K-Edges of Magnesium and Aluminium. J. Veldkamp. *Physica*, 2. *pp*. 933–934, *Nov*., 1935. *In English*.—It is shown that Sandström's explanation (*Diss. Uppsala*, 1935) of the fine structure found at the K-edges of Mg and Al, cannot be correct. By comparing these fine structures with those of Ti and Ca it appears that they agree with Kronig's theory. AUTHOR.

5079. L-Absorption Edge of Protactinium (91). V. Dolejšek and J. Marek. *Zeits. f. Physik*, 97. 1–2. *pp*. 70–72, *Sept*. 23, 1935.—The paper gives the results of the measurements of the L_I, L_{II}, L_{III} absorption edges of protactinium and of the calculations of other energy levels of this element. W. E. P.

5080. Fine Structure of the L_{III} Absorption Edge of the Rare Earths. V. Dolejšek and M. Hylmar. *Comptes Rendus*, 201. *pp.* 600–602, *Oct.* 7, 1935.—For the six rare earths Yb(70), Gd(64), Sm(62), Nd(60), Pr(59) and Ce(58) the fine structure of the L_{III} edge is the same. Details of the spectra are given. C. B. A.

5081. X-Ray Diffraction in Solutions. J. A. Prins and R. Fonteyne. *Physica*, 2. *pp.* 1016–1028, *Nov.*, 1935. *In French.*—Previous work [see Abstract 3087 (1935)] is confirmed and extended. In addition to the cases already reported of $Th(NO_3)_4$ and $UO_2(NO_3)_2$ it appears that a "superarrangement" at least of the kations is present with: $ThCl_4$, UO_2Cl_2, $La(NO_3)_3$, $Cd(NO_3)_2$, $Zn(NO_3)_2$, $Ni(NO_3)_2$, $ZnCl_2$, ZnI_2, $NiCl_2$. Moreover the polyvalent anions of Na_2WO_4, Na_2MoO_4, H_2PtCl_6, HIO_4, $HClO_4$, H_2SO_4 seem to show a superarrangement. With monovalent kations or anions no superarrangement could be found. A rule summarising these results is given. On the other hand HIO_3 is found to belong to the class with "gaseous distribution." This is also the case with CdI_2 in water and alcohol and with $CdCl_2$, $Hg(NO_3)_2$, $Na_3(PW_{12}O_{40})$, $Ce_2(SO_4)_3$, $Zr(NO_3)_4$ in water. In these cases the diffraction pattern gives information on the inner structure of the molecules. AUTHORS.

5082. Focusing of X-Ray Spectra. V. Kunzl. *Comptes Rendus*, 201. *pp.* 656–658, *Oct.* 14, 1935.—By using a crystal with a cylindrical surface it is possible to increase the intensity of the diffracted image obtained with the Bragg-de Broglie method of observing diffracted X-rays. The optimum radius of curvature varies with the wave-length of the radiation but in practice it is only necessary to have a few different curvatures each one serving for a range of wave-lengths. Using this method the author observes and measures M_{IV} and M_{V} for TaO, which have not previously been measured. He reports small differences between the calculated and measured values for ν/R and notes that similar differences have already been reported by Siegbahn for W and some heavier elements. J. E. R. C.

See also Abstracts 4802, 4803, 4804, 4805, 4817, 4823, 4824, 4865, 5247.

HEAT.

CALORIMETRY.

5083. Specific Heats of Liquid Deuterium Oxide. R. S. Brown, W. H. Barnes, and O. Maass. *Canad. J. of Research*, 13. *Section A. pp.* 167–169, *Sept.*, 1935.—Preliminary determinations of the specific heats of liquid D_2O from 4° to 65° C. are described. The average specific heats over the temperature ranges 4° to 26° C., 26° to 45° C., and 26° to 65° C., are 1·018, 1·003 and 1·008 respectively, while the average specific heat between 4° and 65° C. is 1·01 cal./gm.°C. AUTHORS.

5084. Specific Heat of Silver-Mercuric Iodide in Relation to its Crystal Structure. J. A. A. Ketelaar. *Zeits. f. phys. Chem.* 30. *Abt.B.* 1. *pp.* 53–60, 1935.—Immediately below the β–α transition the specific heat of Ag_2HgI_4 increases rapidly, but drops to near the original value above the transition (0·0575, 0·159 and 0·0617 cal./gm. at 40·62°, 50·14° and 51·23° respectively). The molecular heat attributable to the heterogeneous transition is 1·04 k.cal. After negativing an alternative, the "averaged structure" previously described is shown best to explain both specific heat and conductivity changes. [See Abstract 4314 (1934).]

C. A. S.

5085. Specific Heats of Solids at High Temperature. G. Damköhler. *Ann. d. Physik*, 24. 1. *pp.* 1–30, *Sept.*, 1935.—The paper, which is theoretical, deals with the thermal properties of crystals at high temperatures, and especially with the variation of C_v, the specific heat at constant volume, with temperature. The Grüneisen-Debye theory is extended by assuming that the atomic frequency is a function of the temperature, as well as of the volume. It is found that, at high temperatures, C_v should decrease with increase of temperature, as indeed the experimental results suggest in certain cases. The case of a linear chain of atoms is also worked out. L. G. C.

5086. Theory of Specific Heat Anomalies. L. Landau. *Phys. Zeits. d. Sowjetunion*, 8. 2. *pp.* 113–118, 1935. *In German.*—A theory of the specific heat near a transition point is worked out and quantitative agreement with the experimental data on NH_4Cl is claimed. L. G. C.

***5087. Thermocouple Vacuum Calorimeter. W. E. Garner and F. J. Veal.** *Chem. Soc., J. pp.* 1436–1443, *Oct.*, 1935.—A thermocouple calorimeter is described which is employed to measure the heats of adsorption of gases on oxides. It gives accurate results for total heats of adsorption of both slow and rapid adsorption processes, and is successful for the measurement of differential heats of slow processes. Difficulties are met with in the measurement of the differential heats of rapid processes on account of (*a*) poor distribution of gas throughout the oxide and (*b*) a low grain conductivity. Where the adsorbed molecules are mobile within the capillaries, the grain conductivity is usually sufficiently high to give no serious difficulty. For extreme cases it is necessary to work with a small thickness of oxide. AUTHORS.

See also Abstracts 5112, 5129, 5170, 5181, 5229.

CONDUCTION.

5088. Exchange of Energy between Diatomic Gas Molecules and a Solid Surface. J. M. Jackson and A. Howarth. *Roy. Soc., Proc.* 152*A. pp.* 515–529, *Nov.* 15, 1935.—The theory of the accommodation coefficient given by Jackson and Mott is extended for a gas composed of diatomic molecules. Two limiting cases are discussed: (*a*) the gas molecule is treated as an oscillator, (*b*) as a plane rotator. In the first case the exchange of energy between the rotations of the gas molecule and the vibrations of the solid is negligible, whilst in the second the effect of the rotation is very small for H_2 and larger for O_2, taking the same repulsive field of the solid in the two cases. Under these conditions the energy exchange will be larger the larger the moment of inertia of the gas molecule. [See Abstract 5363 (1933).] AUTHORS.

See also Abstract 5170.

CONVECTION.

5089. Instability of a Fluid Heated from Below. R. J. Schmidt and S. W. Milverton. *Roy. Soc., Proc.* 152*A. pp.* 586–594, *Nov.* 15, 1935. —Two brass plates are supported parallel to one another in a glass tank containing water and the lower plate is heated electrically. The water remains at rest until a certain temperature difference is reached, and then convection begins between the plates. The temperature difference at which motion begins agrees, within the limits of experimental error, with a formula predicted from theoretical considerations by Jeffreys. Graphs of the temperature difference between the plates plotted against the rate of heat transfer show a sudden break in direction when instability occurs. Light from a point source is passed through the water and the change in appearance of the image on a screen also shows when instability occurs. AUTHORS.

5090. Optical Method of Determining the Distribution of Heat Transfer Due to Forced Convection. V. Joukovsky, A. Kirejew and L. Schamschew. *Techn. Phys., U.S.S.R.* 1. 4. *pp.* 353–369, 1935. *In German.*—A modification of the optical method described by Schmidt is used to determine the distribution of heat transfer over the curved surface of an electrically-heated cylinder, when subjected to an air stream directed at right angles to its axis. Photographs are reproduced which show that the heat transfer from a cylinder 2 cm. in dia. is greatest from the element of surface facing the wind, decreases to a minimum at each side, and increases to a maximum at the back. For Reynolds numbers ranging from 1000 to 3240, the total heat transfer derived from the photographs agrees within about 10 % with that obtained directly from the measured electrical input, after correcting for the effects of radiation and conduction. For higher Reynolds numbers the results by the optical method appear to be too low, presumably due to the simple theory no longer being applicable. The present values for the total heat transfer are somewhat greater than those given by Hilpert, Ulsamer and Reiher. R. W. P.

DILATATION.

5091. Expansion of Sodium Tungstate between 20° and 600° C. J. B. Austin and R. H. H. Pierce, Jr. *J. Chem. Phys.* 3. *pp.* 683–686, *Nov.*, 1935.—The linear thermal expansion of anhydrous sodium tungstate is determined between 20° and 600° C. by means of an interferometer, with results given by the following equations: $\nu=\nu_{20}[1+53\cdot194(t-20)10^{-6}+41\cdot5(t-20)^2 10^{-9}]$, $\Delta l/l_{20}=17\cdot73(t-20)10^{-6}+13\cdot83(t-20)^2 10^{-9}$, $a_m=17\cdot73\times10^{-6}+13\cdot83(t-20)10^{-9}$, $a_t=17\cdot73\times10^{-6}+27\cdot66(t-20)10^{-9}$. The results show that at atmospheric pressure the salt is trimorphous. Modification III is stable on heating up to 585° at which temperature it transforms to II with an increase in volume of 17·4 %. Form II is stable over a very short temperature interval, whose exact extent could not be determined, and then transforms to Na_2WO_4 I with a decrease in volume of 0·12 %. AUTHORS.

MELTING AND BOILING POINTS.

5092. Melting Curve of Oxygen to 170 kg./cm². J. H. C. Lisman and W. H. Keesom. *K. Onnes Lab., Leiden, Comm. No.* 239*a*. *Physica*, 2. *pp.* 901–906, *Nov.*, 1935. *In English.*—Some points of the melting curve of oxygen are determined, up to $p = 167\cdot7$ kg./cm². and $T = 56\cdot25°$ K. Extrapolation of the curve gives for the triple-point $T = 54\cdot32^{5}°$ K. The density of solid oxygen (γ-modification) at the triple-point, calculated with Clapeyron's equation, appears to be $1\cdot37^2$. AUTHORS.

5093. Diffusion of Volatile Materials into an Inert Gas Stream. E. Preston. *Faraday Soc., Trans.* 31. *pp.* 776–785, *May*, 1935.—Further evidence is advanced for the view that evaporation or volatilisation proceeds from a "super surface" layer in equilibrium with the liquid phase in accordance with the Herz-Knudsen equation, and that its removal is governed by gaseous diffusion into the surrounding atmosphere. The fraction of the ideal rate of evaporation is constant under constant conditions, and fundamentally dependent upon the external pressure. At normal pressures a consideration of this fraction leads to the view that the molecular velocities of molecules leaving the liquid surface are about three times greater than the average velocity of the molecules in the normal gaseous condition, and further that the total energy of such molecules at the moment of leaving the liquid surface is approximately equal to the heat of vaporisation of the material. It has been shown how the diffusion coefficient of the Enskog equation may be regarded as a function of the degree of saturation of the diffusing material in the gas stream, and the probable true relationship indicated between the determined partial pressure and the velocity of the gas stream. [See also Abstract 3806 (1934).] AUTHOR.

***5094. Dew- and Boiling-Point Curves for N_2–CO Mixtures up to 17 Atmospheres. F. Steckel.** *Phys. Zeits. d. Sowjetunion*, 8. 3. *pp.* 337–341, 1935. *In German.*—A simple apparatus is described for the measurement of the dew and boiling points of mixtures which boil at low temperatures. It consists essentially of two vessels capable of withstanding high pressures which are connected together. In one the gas mixture is cooled by liquid O_2 under high pressure, and the pressure-gas quantity curve is observed as the gas is gradually fed into the second vessel. The condensation and boiling points are denoted by pronounced kinks in the curve. The apparatus is tested using $N_2 - O_2$ mixtures, and results are given for N_2 — CO mixtures. It is found for the boiling curve that $P_e = P_{CO} + X_N(P_N - P_{CO})$, and for the dew point curve that $P_a = P_{CO}P_N/(P_{CO}X_N + P_N X_{CO})$, where P_e and P_a are the boiling and dew point pressures, X is the concentration, and P the vapour pressure of the appropriate constituent. R. W. P.

See also Abstracts 4767, 4959, 5109, 5122.

TEMPERATURE, MEASUREMENT OF.

***5095. Resistance Thermometry below 10° K. J. D. Babbitt and K. Mendelssohn.** *Phil. Mag.* 20. *pp.* 1025–1040, *Nov.*, 1935. *Supplement.*—The resistances of a number of phosphor-bronze wires are measured at low temperatures, only one of which proved suitable for a resistance thermometer. Investigations are carried out to determine what factors cause the temperature dependency of the resistance of this wire. It seems as if both the proportion of the constituents and the previous treatment accorded to the wire greatly affect the shape of the resistance curve. A supraconductive component which may be responsible for the temperature dependency below 7° K. is tin-phosphorus, whose transition-point was found to be 8·9° K. The results of the above investigations indicate that a binary alloy of a definite concentration and suitably treated would show a transition curve suitable for a thermometer. A wire of 5 % lead in silver gives a resistance curve which shows that it can be used as a thermometer between 7° K. and 3° K. AUTHORS.

***5096. Simple Thermo-Regulator. H. P. Bloxam.** *Journ. Sci. Instruments*, 12. *pp.* 361–363, *Nov.*, 1935.—A thermo-regulator is described for temperatures up to about 300° C., suitable for laboratory or workshop use where great accuracy of control is not essential. AUTHOR.

See also Abstracts 4975, 5141, 5170.

THERMOCHEMISTRY.

5097. Heat of Dilution of Cadmium Chloride. (Miss) M. Quintin. *Comptes Rendus*, 201. *pp.* 549–550, *Sept.* 30, 1935.—The heat of the reaction Cd (s. sat. Hg) $+2AgCl(s) = CdCl_2$(soln. concn. *m*) $+2Ag(s)$, at temperatures above that at which the e.m.f./temperature curve changes direction is that of the normal reaction. The molecular partial heat of dilution, $\overline{L}_2 = \Delta H_m - \Delta H_0$, is negative for moderately high values of *m*, as it should be when the temperature coefficient of the ionic radius is negative. [See Abstract 3157 (1935).] C. A. S.

5098. Heat of Dilution of Nitric Acid. G. Becker and W. A. Roth. *Zeits. f. phys. Chem.* 174. *Abt.A.* 2. *pp.* 104–114, 1935.—From the numerous data which can be obtained from the new method used to determine the heat of formation of dilute HNO_3 from N_2, O_2 and H_2O, it is possible to ascertain exactly the heat of dilution of HNO_3. The heat of dilution has been determined for HNO_3, 4·5 H_2O to HNO_3, 3800 H_2O at 20° C. It is stated that practically the heat of dilution plays no part. In a bomb calorimeter the constant value 14·8 cal./millimol HNO_3 can be introduced. The course of the heat of dilution is complicated and shows that on dilution three distinct processes are involved. J. K.

5099. Heat of Combustion of Isobutane. F. D. Rossini. *Bureau of Standards, J. of Research*, 15. *pp.* 357–361, *Oct.*, 1935.—The heat evolved in the combustion of gaseous isobutane in O_2 to form CO_2 and liquid water, at 25° C. and a constant pressure of 1 atmosphere, is 2871·06 ± 0·53 international kilojoules per mole. With the factor 1/4·1833, this value becomes 686·31 ± 0·13 k.cal./mol. The isobutane used was estimated to be of such purity that its heat of combustion would differ from that of an absolutely pure sample by less than 0·01 %. The only previous determination is that made by Thomsen over 50 years ago on some impure material. From these new data values are computed for the heat of formation. When combined with previous data on the heat of combustion the present data yield for the reaction, $n - C_4H_{10}$(gas) = $iso - C_4H_{10}$(gas) at 25° C. and 1 atmosphere, $\Delta H = -6\cdot82 \pm 0\cdot63$ kilojoules, or $-1\cdot63 \pm 0\cdot15$ k.cal./mol. AUTHOR.

5100. Combustion of Hydrocarbons. Part I. Influence of Molecular Structure. A. R. Ubbelohde. *Roy. Soc., Proc.* 152*A. pp.* 354–378, *Nov.* 1, 1935.—The methods used include: chemical identification of intermediate compounds of the oxidation; study of reaction kinetics, chemi-luminescence, the induction period and wall effects, the action of positive and negative catalysts; and comparison of the behaviour of isomerides and of substituted hydrocarbons. Energy factors in the combustion are considered, and the probable importance of vibrational energy, particularly at low temperatures, is substantiated with the help of simple models of the molecules. The reaction mechanism developed as a result of the discussion involves peroxide radicals and molecules and, in particular, provides a mechanism of chain branching which accounts for special phenomena observed in the low-temperature region of combustion. Further support for this mechanism is obtained from the oxidation of hydrocarbon molecules sufficiently long to permit ring-closure. [See following Abstract.] T. H. P.

5101. Combustion of Hydrocarbons. Part II. Absorption Spectra and Chemical Properties of Intermediates. A. R. Ubbelohde. *Roy. Soc., Proc.* 152*A. pp.* 378–402, *Nov.* 1, 1935.—The work described is a development of that of Egerton and Pidgeon [see Abstract 4940 (1933)]. Compounds showing characteristic absorption spectra and capable of arising during the slow combustion of hydrocarbons have been studied, as well as the spectra and slow combustion of ring compounds including one O atom. The influence of certain catalysts, such as NO_2, on this slow combustion has also been investigated. The results indicate that the formation of O-ring compounds is of great importance in elucidating the oxidation mechanism of the higher paraffins at low temperatures. It is suggested that the formaton of saturated O-rings, such as methyltetrahydrofuran, corresponds with an internal oxidation by the energy-rich peroxide $CH_3\cdot[CH_2]_4\cdot OOH$ and that unsaturated O-rings are formed by a similar process from an energy-rich peroxide radical, such as $CH_3\cdot[CH_2]_4\cdot OO$. Two of these ring compounds are definitely indicated, but other modes of ring closure are not excluded. [See preceding Abstract.] T. H. P.

5102. Ignition of Gases. Part IX. Ignition by a Heated Surface. C. A. Naylor and R. V. Wheeler. *Chem. Soc., J. pp.* 1426–1430, *Oct.,* 1935.—At temperatures leading to ignition the oxidation of CH_4 is a thermal reaction catalysed by the products of an initial slow and flameless combustion. This conclusion [see Abstract 4977 (1933)] is now supported by observations on the ignition of CH_4-air mixtures at reduced pressures; it is not necessarily in conflict with the views of those who, experimenting with CH_4-O_2 mixtures at lower temperatures, have explained the results as being due to a chain mechanism. In the present work, the reactions are not isothermal, for a notable self-heating towards the end of the period of lag is proved by a much greater rise in pressure than that due to the change in the number of molecules present. From experiments with CH_4-air mixtures containing an inhibitor which poisoned the surface of the reaction vessel, it is concluded that most of the initial chemical change at normal pressure, in the absence of the inhibitor, takes place at the surface, so that at reduced pressures, when the reaction tends to leave the surface, either a longer time or a higher temperature is required to bring about ignition. Mixtures of air near that containing CH_4 and O_2 in combining proportion inflame at lower temperatures when the pressure is reduced, because the reaction, although initially extremely slow, accelerates in a mixture that still contains a high proportion of reactive constituents. Outside this narrow range of mixtures, higher temperatures are required to cause ignition as the pressure is reduced, because the mixtures tend to become non-inflammable. H. H. Ho.

5103. Ignition of Explosive Gas Mixtures by High-Speed Electrons. A. E. Malinowski and K. A. Skrynnikow. *Phys. Zeits. d. Sowjetunion*, 8. 3. *pp.* 289–293, 1935. *In German.*—The authors used a similar experimental method to that described previously [see Abstract 2178 (1935)] but for the present experiments explosive mixtures of Cl_2 and H_2 were selected because they react together so readily. In no case was an explosion observed although control experiments using u.v. light gave positive results. The authors suggest that to bring about an explosion the concentration of electrons must be such that the number of ions produced by them is the same as that present in the flame. This is technically possible by using stronger tubes with current density of about 6×10^{-2} amp./mm². R. L.

5104. Explosion Waves and Shock Waves. Part III. Initiation of Detonation of C_2H_4–O_2 and CO–O_2 Mixtures. W. Payman and H. Titman. *Roy. Soc., Proc.* 152*A. pp.* 418–445, *Nov.* 1, 1935.—This series of papers has so far dealt mainly with non-maintained or partially maintained atmospheric shock waves, and only incidentally with the fully-maintained detonation wave. In the present article the initiation of detonation and the production of shock waves and their effect on the flame prior to the setting up of detonation are studied. The mixtures used are C_2H_4 and O_2, which detonate with ease, and of CO and O_2 which do so with comparative difficulty. When shock waves are formed, they may push the flame forward at a lower speed than that at which they are passing through it, or they may retard the flame on meeting it after reflection from a closed end; hence in a closed system the flame may be made to oscillate. The shock waves do not necessarily travel throughout the unburnt gas at uniform speed relative to the wall of the tube, for the gas may be moving at varying velocities at different distances from the flame. Waves travelling from hot to cold gases diminish in speed, whilst they increase in speed on travelling from cold to hot gases; on meeting a flame they are partially reflected, with change of sign under suitable conditions, and partially transmitted. On collision with a solid obstruction they are reflected, usually at a lower speed. Detonation may be set up either ahead of or, more usually, within the flame front, due to the effect of (1) waves travelling in front of or from behind the flame, (2) the collision or overtaking of wave and flame or wave and wave, or (3) the collision of a wave with an obstruction or the closed end of the tube. [For Part V see Abstract 1726 (1935).] H. H. Ho.

5105. Upper Temperature Limit of Detonation of Explosive Substances. K. K. Andreew. *Acta Physicochimica*, 3. 1. *pp.* 119–126, 1935. *In German.*—Experimental data are given for the following substances: trotyl, picric acid, tetryl, trinitroresorcinol, pentaerythrite tetranitrate, nitroglycerin and explosive gelatin, showing their behaviour at different temperatures. The paradoxical result is obtained that increase of temperature decreases the intensity of decomposition, indicating that other factors exist which exert an essential influence upon the act of detonation and which diminish at higher temperatures. H. H. Ho.

5106. Theory of the Bunsen Flame. A. Predvoditelev. *Techn. Phys., U.S.S.R.* 2. 4. *pp.* 364–368, 1935. *In English.*—In criticism of Michelson's theory of the bunsen flame the author states that there is no logical reason for taking the velocity of unburnt gas inside the cone of the flame as parallel to the generatrix of the cylindrical tube through which the gas is discharging. He points out that only a knowledge of the process connected with the discharge of a gas into free space will lead to correct diagnosis of the action. The inner cone of the flame is shown to be a representation of the hydrodynamical law of the distribution of velocities over the cross-section of the torch. Tables of calculated results are shown to be in close agreement with photographic reproductions of actual flames. S. G. B.

See also Abstracts 5030, 5031, 5087, 5119.

THERMODYNAMICS.

5107. Series of Equations of State. T. Pinter. *Acta Physica Polonica,* 4. 1–2. *pp.* 23–35, 1935. *In German.*—It is pointed out that the equation of state given by Wohl (*Zeits. f. phys. Chem.* 99. 207, 1921) is of the 4th order in v, and is van der Waals' equation plus an extra constant. This extension is possible since at the critical point the four roots of the equation are real and equal. In a similar way one can form an equation of the 5th order with 5 constants, and so on. Thus a continuous series of equations of state can be developed, and the general form of the equation in the nth order in v, and containing n constants is given. This can be written in a reduced form, in which the individual constants vanish. It is shown how an equation of state of the 5th order can be regarded as being applicable to associated substances. R. W. P.

5108. Properties of Real Gases Based on the Simplified Jacyna Equation of State (He, Ne, H_2). S. Derewjankin, A. Obnorsky, and T. Parfentjew. *Acta Physica Polonica,* 4. 1–2. *pp.* 37–51, 1935. *In German.*—The Joule-Thomson effect μ_j for He appears to be a constant quantity of about $-0{\cdot}061°$ C./atm., whereas for Ne and H_2 the effect is dependent upon temperature. The Joule effect μ_U varies appreciably with pressure and temperature, and μ_U is always negative for He. The following data have been calculated from the specific heats: $S_{Ne} = 3$ and $S_{H_2} = 5$, and approximately $m_{He} = 4{\cdot}002$, $m_{Ne} = 20{\cdot}18$ and $mH_2 = 2{\cdot}016$. The calculated a- and β-values are the true values of the expansion and pressure coefficients which are connected with the observed average a_m and β_m data between 0° and $t°$ C. by means of the expressions: $a = a_m + t(\delta a_m/\delta t)_p$, $\beta = \beta_m + t(\delta\beta_m/\delta t)_v$. Finally, the calculated agree fairly well with the experimental data, but not completely, since the comprehensive simplification of the equation of state requires an appreciable variation of the differential coefficients. [See Abstracts 3939 and 4320 (1935).] H. H. Ho.

5109. Fusion Diagram for Oxygen-Nitrogen and the State Diagram for Nitrogen-Carbon Monoxide. M. Ruhemann, A. Lichter and P. Komarow. *Phys. Zeits. d. Sowjetunion.* 8. 3. *pp.* 326–336, 1935. *In German.*—The melting and freezing point curves are established for mixtures of O_2 and N_2 and of CO and N_2 by a method [see Abstract 4635 (1934)] which is based upon specific heat measurements. The equilibrium curve for the transformation β–a is also determined for mixtures of

N_2 and CO; the latter form two complete series of mixed crystals. O_2–N_2 mixtures possess a eutectic point at 50·1° K and 23 % N_2. N_2 dissolves in the O_2 lattice to the extent of 15·5% and conversely 69% of O_2 dissolves in the N_2 lattice. The total heats of fusion for mixtures of O_2 and N_2 decrease appreciably from the values for the pure substances and possess a minimum in the neighbourhood of the saturation concentration of the N_2 lattice. H. H. Ho.

5110. Generalised Thermodynamic Notation. H. A. C. McKay. *J. Chem. Phys.* 3. *pp.* 715–719, *Nov.*, 1935.—It has recently been shown by Koenig [see Abstract 801 (1935)] that, as a result of the symmetry of the fundamental relations of thermodynamics, thermodynamic equations can be grouped into families. In the present paper a generalised notation is described which leads to an elegant method of writing down from one generalised equation all the members of a family; in particular, the signs of the various terms are very easily manipulated. The question of the number of members of a family is considered, and a method is given for obtaining the generalised equation when any one member of a family is known. Finally the extension of the method to problems of capillarity, magnetisation, etc., is shown to be very readily carried out. AUTHOR.

5111. Critical Data, and Density-Temperature Diagrams for Light and Heavy Water. E. H. Riesenfeld and T. L. Chang. *Zeits. f. phys. Chem.* 30. *Abt.B.* 1. *pp.* 61–68, 1935.—It is found that the critical temperature T_c of a mixture of light and heavy water is given by $T_c = 374 \cdot 2 - 2 \cdot 7n$, where n is the molar fraction $D_2O/(H_2O + D_2O)$. The following are the critical constants for D_2O, temperature 371·5° C., pressure 218·6 atmospheres, density 0·363 gm./cm³. The density-temperature diagrams for H_2O and D_2O are given, and indicate two points at which common values occur. Both saturated vapours have a density of $9 \cdot 55 \times 10^{-5}$ gm./cm³. at 49·5°C., and both liquids have a density of 0·460 gm./cm³. at 370·0° C. R. W. P.

***5112. Caloric and Thermal Properties of Condensed Heavy Hydrogen. K. Clusius and E. Bartholomé.** *Zeits. f. phys. Chem.* 30. *Abt.B.* 4. *pp.* 237–257, 1935.—The experimental part of the paper deals with: 1. The preparation of pure D_2. 2. Apparatus for the measurement of the heat of evaporation. 3. Experimental arrangements for the measurement of molecular heat and heat of fusion. 4. Construction of the fusion curve. 5. Estimation of the molecular volume. The experimental results are as follows, each figure in brackets being the corresponding datum for H_2: Heat of evaporation at 194·5 mm. Hg, 302·3 cal. (219·7 cal.); heat of sublimation at absolute zero, 274·0 cal. (183·4 cal.); heat of fusion, 47·0 cal. (28·0 cal.); Θ value of Debye (for C_p), 89° (91°); fusion temperature, 18·65° K (13·95° K); slope of the fusion curve at the triple point, 40·5 kg./cm². (30·3 kg./cm².); $v_{\text{liq.}}$ at the triple point, 23·14 cm³. (26·15 cm³.); Δv at the triple point 2·66 cm³. (2·83 cm³.); v_{solid} at the triple point, 20·48 cm³. (23·31 cm³.); lattice zero point energy $\sim$ 215 cal. ($\sim$ 305 cal.); The two isotopes exhibit very considerable differences which should not exist on previous hypotheses, and these are all explicable on the assumption of equal intermolecular forces but different zero point energies and different anharmonic values of the lattice vibrations. H. H. Ho.

5113. Entropy of Heavy Hydrogen. K. Clusius and E. Bartholomé. *Zeits. f. phys. Chem.* 30. *Abt.B.* 4. *pp.* 258–264, 1935.—The entropy of D_2 has been calculated from thermal data at 298·1° to be $33 \cdot 91_5$

cal./mol./deg. [see also Abstract 3547 (1935)]. The corresponding statistically calculated absolute value of the entropy is $38 \cdot 98_1$ cal./mol./deg. The difference of $5 \cdot 06_9$ entropy units can be interpreted on the asssumption that the para-D_2-molecules freely rotate up to 10° K. in the lattice with $J_{red} = 1$, and that the multiple nuclear spins of the ortho- and para-molecules are preserved. Under these conditions the entropy difference should amount to, $R \ln 9 + 1/3 R \ln 3 = 5 \cdot 09$ entropy units; this value is in excellent agreement with the observed data. For practical thermodynamical calculations, the absolute value $34 \cdot 62_0$ entropy units is used, this having been corrected for the nuclear spin entropy ($R \ln 9$). At low temperatures the chemical constant J'_k has the value for ortho-D_2 of $-0 \cdot 68$, and for normal D_2 the value $-0 \cdot 522$. The vapour pressure constant of normal D_2 is $J'_p = -0 \cdot 67_0$; at high temperatures $J'_k = -2 \cdot 61_5$ and $J'_p = -2 \cdot 76_3$. H. H. Ho.

5114. Kinetic Interpretation of the Inner Effect. V. Njegovan. *Zeits. f. Physik.* 97. 5–6. *pp.* 390–394, *Oct.* 18, 1935.—By increase of the rotation or vibration of the ideal elastically conceived gas molecule, its radius is reduced whereby energy is set free, and this liberated energy is now interpreted as the inner effect $\int_0^c T\,dC$. Similar considerations apply to thermal dissociation, ionisation, etc., for real gases, and in connection therewith a simple explanation is given for the so-called degeneration of gases. H. H. Ho.

5115. Application of Chemical Potential Equations to Partially Miscible Solutions. G. Scatchard and W. J. Hamer. *Am. Chem. Soc., J.* 57. *pp.* 1805–1809, *Oct.*, 1935.—Equations for the free energy of mixing are computed from the mutual solubilities of partially miscible substances, and the vapour compositions and pressures computed from these equations are compared with the experimental measurements with good agreement. Guggenheim's treatment [see Abstract 1214 (1935)] is discussed and found less satisfactory than the simpler one given here. AUTHORS.

5116. Application of Chemical Potential Equations to Solid and Liquid Solution Equilibria. G. Scatchard and W. J. Hamer. *Am. Chem. Soc., J.* 57. *pp.* 1809–1811, *Oct.*, 1935.—Simple equations for the change in chemical potentials on mixing are applied to the equilibria between solid and liquid solutions of the Ag-Pd and the Au-Pt systems, and some general conclusions are noted. AUTHORS.

5117. Thermodynamics of Ionised Water in Sodium Chloride Solutions. H. S. Harned and G. E. Mannweiler. *Am. Chem. Soc., J.* 57. *pp.* 1873–1876, *Oct.*, 1935.—From measurements of the cells $H_2|NaOH(0 \cdot 01)$, $NaCl(m)|AgCl|Ag$ and $H_2|HCl(0 \cdot 01)$, $NaCl(m)|AgCl|Ag$ in aqueous solutions at 0°–60° C., the value of the ionic activity coefficient product of water in NaCl solutions has been calculated. At a given concentration the logarithm of the ionisation in alkali halide solutions ($\log m_H m_{OH}$) varies nearly linearly with the sum of the reciprocal of the ionic radii. This relation, although only approximate, indicates that ions of smaller radii cause the greater dissociation of the solvent. The total heat content of the ionisation of water and the relative partial molal heat content of the H and OH ions in NaCl solutions has been determined for temperatures ranging from 0° to 60° C.; good agreement with the calorimetric heat of neutralisation is found at 20° C. T. H. P.

5118. Free Energy of the Dissociation of Hydrogen. E. N. Erjemin. *Acta Physicochimica,* 3. 1. *pp.* 147–150, 1935. *In German.*—With the help of the spectroscopic values of the heat capacity and of the heat of dissociation of H_2, the following general equation for the free energy of the dissociation is derived: $\Delta F^\circ = 102{,}000 - 7\cdot185\ T \log T + 0\cdot000033\ T^2 + 0\cdot0000000465\ T^3 - 2\cdot332\ T$. This equation gives values agreeing well with those calculated by Giauque for different temperatures [see Abstracts 1972 and 1973 (1931)]. T. H. P.

5119. Quantity and Intensity Parameters and Stable Equilibrium. M. Planck. *Physica,* 2. *pp.* 1029–1032, *Nov.,* 1935.—*In German.*—The author expounds his notions concerning intensity parameters and stable equilibrium in reply to the contention of Ehrenfest-Afanassjewa and Haas-Lorentz that their definition of "intensity parameter" [see Abstract 3575 (1935)] possesses advantages over that proposed by the author. Planck considers that the notion of stable equilibrium is the more fundamental idea. The ideas are illustrated by a brief treatment of the thermodynamics of a gas. J. S. G. T.

See also Abstracts 4863, 5092.

VAPOUR PRESSURE.

5120. Vapour-Pressure Change of Hydrogen Isotope Mixtures. K. Steiner. *Phys. Zeits.* 36. *pp.* 659–660, *Oct.* 15, 1935. *From the Reichsanstalt.*—The vapour pressures of mixtures of hydrogen isotopes are found to decrease with time at 20·38°K. For D_2 contents of 2·4, 13·9, 24·6, 47·8, and 94·3 atomic % the changes in 10 hr. amount to 5·6, 13·3, 18·6, 25·3 and 5·0 mm. of Hg respectively. The samples usually contain H_2, HD and D_2 molecules, but the concentration of HD decreases at low and high D_2 contents. It is suggested that since pressure decrease is a function of HD content it may result from a change of HD to a modification having a lower vapour pressure. R. W. P.

5121. Vapour Pressures of Ortho and Para Deuterium. F. G. Brickwedde, R. B. Scott and H. S. Taylor. *Bureau of Standards, J. of Research,* 15. *pp.* 463-475, *Nov.,* 1935. *J. Chem. Phys.* 3. *pp.* 653–660. *Nov.,* 1935.—The difference between the vapour pressures, $\Delta P(e\text{–}n)$, of the 20·4° K. equilibrium mixture and the normal mixture of the ortho and para varieties of D_2 are determined from 15° to 20·4° K. $\Delta P(e\text{–}n)$ varies from 0·3 mm. of Hg at 15° K. to 3·8 mm. at 20·4°. $\Delta P(e\text{–}n)$ for deuterium is small as compared with $\Delta P(e\text{–}n)$ hydrogen, but $[\Delta P\ (\text{ortho-para})/P(n)]$ for deuterium is approximately equal to $[\Delta P\ (\text{para-ortho})/P(n)]$ for hydrogen at the same temperature. Further measurements are made on the uncatalysed change with time of the vapour pressure of liquid normal deuterium. The change for deuterium is *less* than 1 mm. of Hg in 200 hr., whereas the vapour pressure of liquid normal hydrogen increases 1 mm. in 4 hr. This large difference in rates is attributable to the difference in magnetic moments of the proton and deuton. If Wigner's theory of the ortho-para conversion by paramagnetic molecules in the gaseous phase is extended to the liquid phase to calculate the relative rates of change of the vapour pressures of liquid normal deuterium and liquid normal hydrogen, a ratio of 1/1000 is obtained for the ratio of the rate of change for deuterium to the rate of change for hydrogen. AUTHORS.

***5122. Vapour Pressures of Neon of Different Isotopic Compositions. W. H. Keesom and J. Haantjes.** *K. Onnes. Lab., Leiden, Comm. No.* 239*c. Physica.* 2. *pp.* 986–999, *Nov.*, 1935. *In English.*—A description is given of a cryostat for liquefying Ne with the aid of liquid H_2 and of a special apparatus for differential measurements of vapour pressures by means of which a very good heat contact between the bath and the vapour pressure reservoirs is secured. The difference in vapour pressure of Ne of different isotopic compositions in the atomic weight range between 20·04 and 21·16 is measured, and the results show that at a fixed temperature the pressure is a linear function of the atomic weight. The value of log P_{20}/P_{22} as a function of temperature is derived, also for the solid state a theoretical formula for this quantity, and the deviation from this formula which is found is discussed. The difference in some caloric properties of the two isotopes are discussed and the triple-point temperature of Ne^{22} is found to be 0·134 degree above that of Ne^{20}. AUTHORS.

***5123. Differential Tensimeter and Vapour Pressures of Deuterates of Copper Sulphate. H. Perpérot and F. Schacherl.** *J. de Physique et le Radium,* 6. *pp.* 439–440, *Oct.*, 1935.—The tensimeter has the advantage that it has no taps. Condensed liquids can be recovered in a high state of purity, allowing further experiments to be performed with them. A method of preparing deuterates of $CuSO_4$ is described. Vapour pressures for $CuSO_4$, $5H_2O$ and $CuSO_4$, $3H_2O$ are found to be 7·8 mm. and 5·6 mm., and for the peuta- and trideuterates 5 mm. and 3·6 mm. The decrease when D replaces H is in agreement with Macdonald and Lewis's work on D_2O. C. J. B. C.

5124. Influence of Surface Perturbations upon the Interior of "Real" Crystal Systems. D. Balarew. *Zeits. f. phys. Chem.* 30. *Abt.B.* 2–3. *pp.* 152–156, 1935.—A new confirmation of the effect by direct determination of vapour-pressure in the system $BaCl_2 2H_2O \rightleftarrows BaCl_2H_2O + H_2O$. Experiments included the pure substances, as well as when mixed with other salts. [See Abstracts 4403 (1934) and 1219 (1935).] F. I. G. R

See also Abstract 5093.

ACOUSTICS.

5125. Response Measurement and Harmonic Analysis of Violin Tones. R. B. Abbott. *Acoustical Soc. of America, J.* 7. *pp.* 111–116, *Oct.,* 1935.—The violins were fixed in turn on a special stand and bowed by mechanical means, similar to that of the endless rope, which allowed the pressure, speed and position of the bow to be controlled. When the pressure of the bow changed from 20 to 200 gm. wt., the response or output of the string was constant at 91·4 db with constant bow speed. If the bow speed was changed, at constant pressure, from 15 to 60 cm./sec., the response increased from 84 to 97 db. The violins, of which 11 were new and 10 old, were also tested as to tone-centre and its pitch or tone-centroid, a quantity which is characteristic of the violin. If the tone-centre has high pitch, the tone is metallic and rough ; if it is low, the tone is soft and melodious. Tonal balance and quality were also investigated, and the partials are shown for a 25 dollar and a 10,000 dollar violin. G. E. A.

***5126. Ultrasonic Total Reflectometer to Measure Speed of Sound and Elastic Constants of Solids. W. Bez-Bardili.** *Zeits. f. Physik,* 96. 11–12. *pp.* 761–786, *Sept.* 18, 1935.—The critical angle of total reflection was measured, and the velocity of sound calculated, for longitudinal and transverse waves of frequencies from 10^6 to 2×10^7, in various metal and glass plates in xylol. Also a new method was employed to determine the speed from the transparency maxima of the plates as dependent on the angle of incidence. A decrease of speed of transverse waves was found with smaller angles of incidence, and a constant speed for larger angles. It was also found that a certain dependence of transverse and longitudinal waves on the frequency could be explained by the presence of coupled longitudinal and transverse waves. With diminishing wavelength an asymptotic value is reached, the velocity in an infinite medium, from which all the elastic constants of the plates were determined. The value found for xylol was 1321 ± 4 m./sec. at 20° C. The speeds calculated for audible frequencies were : Al 4990, Fe 5110, Cu 3630, brass 3520, and glass 5230 m./s. G. E. A.

5127. Velocities of Ultrasonic Waves in Heavy Water. R. Bär. *Helv. Phys. Acta,* 8. 6. *pp.* 500–502, 1935. *In German.*—The velocity in D_2O of an ultrasonic wave is determined by the diffraction it produces in a light wave. The piezo-quartz is driven at a frequency of $7 \cdot 5 \times 10^6 \sim$ and forms one side of the vessel containing the liquid under test. Small quantities of liquid, less than 1 cc., are sufficient. The velocity for water is $1 \cdot 481 \times 10^5$ cm./sec. as compared with $1 \cdot 4842 \times 10^5$ cm./sec. obtained by sound interferometry by Hubbard and Loomis. In 99·2 % D_2O, the velocity at 20° C. is $1 \cdot 381 \times 10^5$ cm./sec. giving an adiabatic compressibility of $4 \cdot 733 \times 10^{-11}$ cm^2./dyne. H. M. B.

5128. Frequency Change of Light through the Doppler Effect in Diffraction due to Ultrasonic Waves. L. Ali. *Helv. Phys. Acta,* 8. 6. *pp.* 502–505, 1935. *In German.*—A mercury resonance lamp (2537 Å) is used as the source of light, which is diffracted by a stationary ultrasonic wave and then passed into a vessel containing Hg-vapour. The change in frequency is measured by the degree of absorption of the wave. The vessel containing the vapour is placed in a magnetic field of variable strength. Results show that for zero fields, the intensity of the light after absorption increases with the order of the diffraction. For increasing magnetic field, the transmitted intensity decreases to a minimum and then increases linearly. The equation for the frequency of the diffracted light is $\nu_n = \nu_o \pm n\Omega$ where ν_o is the frequency of the original light, Ω the frequency of the sound, and n the order of diffraction. Experimental results are not altogether in agreement with this. H. M. B.

5129. Excitation of Intramolecular Vibrations in Gases and Gas Mixtures by Collisions, based on Measurements of Sound Dispersion. Part III. A. Eucken and H. Jaacks. *Zeits. f. phys. Chem.* 30. *Abt.B.* 2–3. *pp.* 85–112, 1935.—Continuation of a research [see Abstract 810 (1935)] on the exchange of translational and vibrational energy in N_2O pure and with additions of other gases. The ultrasonic method was employed between − 60° and 200° C., and between 1/3 and 1 atmosphere pressure. N_2O is de-activated by its own molecules and by those of NH_3, in the same way as CO_2 is de-activated by H_2. A considerable difference between the gases consists in the effect, brought out when investigating the dependence of the heat of vibration on temperature, that on addition of H_2 the valence vibration of N_2O is comparatively strongly excited. Measurement of the collision exchanges of H_2, D_2 and He as added gases indicated the possibility of formulating more precisely the difference between the physical and chemical modes of excitation by collision. G. E. A.

5130. Absorption of Supersonic Waves in Liquids. P. Bažulin. *Phys. Zeits. d. Sowjetunion,* 8. 3. *pp.* 354–358, 1935. *In German.*—The absorption of supersonic waves in liquids was investigated by making use of the diffraction of light at these waves [see Abstracts 4457 and 4458 (1932)]. A homogeneous parallel beam of light fell on a series of equidistant slits. The separate bundles of rays which issed from the slits passed through a vessel of liquid at different distances from the source of sound (piezo-quartz) ; and the diffraction images obtained from the separate slits were simultaneously photographed. The investigation of the fading of the supersonic waves in liquids was carried out by two methods, and the results of the measurements of the absorption coefficients in three different mixtures of vaseline oil and petroleum, and in CCl_4 are given. J. J. S.

***5131. Design of Bell Towers. G. M. Giannini.** *Acoustical Soc. of America, J.* 7. *pp.* 135–138, *Oct.*, 1935.—In U.S. towns where noise level is high, the sound output of bells imported from Europe has been unsatisfactory. It is therefore suggested that the optimum height for the bells should be determined in order to cover a definite listening area, and, since the radiation characteristic becomes much more directional at the higher frequencies, the smaller bells should be mounted below the heavier and louder ones. Also the smallest bells might be arranged in duplicate or quadruplicate in separate reflecting chambers, and a more open structure round the belfry would permit free radiation of the bell tones. G. E. A.

5132. Electro-Acoustics and Bells. G. M. Giannini. *Rev. Sci. Instruments,* 6. *pp.* 293–295, *Oct.*, 1935.—A bell when struck emits a number of fundamentals, each one of which has its natural harmonics. The third tone of the bell, is not considered strictly musical, and it sets up undesired combinational tones. It is indicated how, by using rubber dampers, the bell may be prevented from emitting this tone, and the sound of bells may be corrected. By the use of small bells in conjunction with a special pick-up and amplification still greater improvement may be obtained. G. E. A.

✱**5133. Registration of Speech Sounds. E. W. Scripture.** *Acoustical Soc. of America, J.* 7. *pp.* 139–141, *Oct.*, 1935.—The registered sound of *choo* on a sound film is shown and discussed, and an equation is given which provides for the expression of all amplitudes, pulsatances and decrements of a vibration between given limits. In vowel registrations, neither the pulsatance nor the factor of decrement is necessarily constant during the vibration. An apparatus with a mouth-piece and a membrane of oiled silk registers the movements of the air in the vocal organs on a moving smoked surface. The membrane follows the gross changes in air pressure but not the vibrations. A graphic registration of the word *choo* by this apparatus is reproduced and discussed. G. E. A.

5134. Loudness of Clicks, Noises, and Tones. W. Bürck, P. Kotowski and H. Lichte. *E.N.T.* 12. *pp.* 278–288, *Sept.*, 1935.—The authors deduce the perceptibility-time curve of the ear by applying to it repeated clicks by means of a rotating commutator, and then show that it is possible to estimate the relative loudness of short period sounds by assuming linearity in aural response and taking an aural time-constant of 50 milli-seconds, the loudness contours of Fletcher and Munsen being accepted. This is worked out mathematically. This effective loudness can therefore also be realised on a thermo-instrument having a similar time-constant, the frequencies being corrected by electrical filters to simulate the frequency response of the ear for steady tones. It was not found that the non-linearity in the ear had an appreciable effect on the resulting loudness. L. E. C. H.

✱**5135. Audio-Frequency Recording Analyser. H. H. Hall.** *Acoustical Soc. of America, J.* 7. *pp.* 102–110, *Oct.*, 1935.—Description of a heterodyne apparatus containing microphone, amplifier, balanced modulator, band-pass filter, logarithmic voltmeter, oscillator, kathode-ray tube and camera. The band of frequencies to be analysed is led to the modulator to which is applied another wave of frequency which may be varied between 20,000 and 30,000 ∼. The output of the modulator is applied to a narrow band-pass filter of a magnetostrictive type whose centre is at 20,000 ∼. The frequency of the oscillator is varied continuously from 20,000 to 30,000, and the only combination frequencies present are those of the sum and difference. These vary with that of the oscillator, and the components of the difference frequency band are in turn transmitted by the filter, each component actuating a recording device as it is transmitted. Analyses ranging from 50 to 10,000 ∼ may be made by the apparatus in 3·78, 6·61 or 10 sec. Examples of photographed analyses include noise of vacuum cleaners, tones of the four violin strings, and the eight cardinal vowel sounds. G. E. A.

5136. Mechanical and Acoustic Impedance. F. Bedeau. *J. de Physique et le Radium*, 6. *pp.* 407–416, *Oct.*, 1935.—A study is made of circuits of the second group, acoustic impedance formulæ being obtained applicable to tubes, etc., first for the case of plane waves and secondly for the case of converging or diverging waves. [See also Abstract 4642 (1935).] A. W.

See also **Abstracts 4783, 4973, 5104, 5141.**

ELECTRICITY AND MAGNETISM.

ALTERNATING-CURRENT NETWORKS.

***5137. Sensitive Visual Detector for A.C. Bridge Measurements. C. K. Strobel.** *Rev. Sci. Instruments,* 6. *pp.* 319–320, *Oct.,* 1935.—A small full-wave copper-oxide rectifier, connected to a sensitive d.c. galvanometer, is used as a visual a.c. bridge detector, which not only covers the range of audio-frequencies with the same degree of sensitivity as a good telephone receiver, but extends down to zero frequency with no reduction in sensitivity and into the frequency range above audibility (up to 20,000 ∼) with only slightly reduced sensitivity. The precaution of shunting the detector is found to be necessary when the bridge is not automatically balanced for both the fundamental and the harmonic components of the input voltage. T. I. J.

***5138. Measurements of Dielectric Constant and Conductivity at Radio Frequencies. H. Gross and I. Hausser.** *Ann. d. Physik,* 24. 2. *pp.* 127–160, *Oct.,* 1935.—An account of a r.f. bridge of a new type. The conventional Wheatstone bridge network is opened at one of the corners at which voltage is applied, and a separate voltage is applied to the two arms, both sources being connected to the opposite corner. The two sources are derived from the same oscillator through two amplifiers whose amplitudes and phase can be varied. The bridge is balanced by varying the amplitude and phase of the voltage applied to one of the arms. The wave-length range covered is from 50–3000 m. W. H. W.

CONDUCTION AND DISCHARGE IN GASES.

5139. Electrical Conductance of Short Gaps in Air. E. Hutchisson, T. H. Osgood and R. E. Fearon. *Nat. Acad. Sci., Proc.* 21. *pp.* 542–548, *Sept.,* 1935.—The dependence of conductance upon gap width under ordinary conditions, *e.g.,* such as those found in switch contacts operated in air, are investigated experimentally. The gaps used are effectively those between a spherical electrode of radius 14×10^2 cm., 14 cm. or 25×10^{-4} cm. and a plane, the surfaces being of steel in some cases, of tungsten wire in others. The results indicate that appreciable current can pass between surfaces of approximately 4 cm. dia. which are separated by as much as 10,000 Å in air. The current passing is proportional approximately to the square of the applied p.d.; this indicates that the conduction is effected by charged dust particles moving cyclically from one electrode to the other. At very small separations of the electrodes the current definitely obeys Ohm's law, and is probably carried by metallic bridging. J. S. G. T.

5140. Characteristics of the Electric Arc. A. Kotecki. *Acta Physica Polonica,* 4. 1–2. *pp.* 113–122, 1935. *In French.*—The characteristics of electric arcs ($e = f(1/i)$) were studied for electrodes of Cu, Fe, Al and C for the cases when both electrodes were of the same material and of different materials, *e.g.,* C-Cu, Fe-C, C-C, etc. The experiments were carried out with d.c. at 220 V in the region of 1–20 A at electrode distances of 1–5 mm. and the results are given graphically in a series of curves. These are discussed and compared with both practical and theoretical results of other workers. R. L.

5141. Arc Temperatures by an Optical Method. C. G. Suits. *Physics*, 6. *pp*. 315–322, *Oct*., 1935.—Use is made of the fact that when a pressure wave enters an electric arc there is an increased luminosity in the high pressure region. The progress of the wave may therefore be followed photographically and the temperature of the arc determined from measurements of the wave velocity. The gas temperature across the arc is found to be constant within the error of observation (100° K.). It is noted that a small partial pressure of Na lowers the arc temperature by about 1500°. The effective ionisation potential is deduced for a number of arcs and is in all cases above that of the metallic vapour and below that of nitrogen. Calculation of the degree of dissociation is made and used to explain the impossibility of arc welding in pure argon. J. E. R. C.

5142. Pressure Conditions Associated with Dark Discharge (Corona). M. Radonjitch and A. Thoma. *Arch. f. Elektrot*. 29. *pp*. 692–701, *Oct*., 1935.—The authors investigate the rise of pressure accompanying dark discharge (corona) in a closed space. J. Kunz's theory, confirmed by E. H. Warner's investigations, attributes the pressure-rise solely to the ionisation which occurs. The authors repeat and extend Warner's experiments, and investigate the effect on the pressure of variations in voltage, material of wire, and gas. The apparatus and method are fully explained, and charts are reproduced showing the pressure-rise as a function of the discharge current for different static pressures, and as functions of time (constant current), and volume of enclosure. The material of the discharge wire has no effect. The authors were unable to produce a dark discharge in CO_2; all their tests were made in air. They conclude that the observed pressure-rise is mainly a thermal effect. This is confirmed by separate heating tests, and it offers an explanation for the different rises of pressure observed by Warner in different gases. R. E. N.

5143. Use of Cloud Chamber for Investigation of Phenomena Prior to Spark and Corona Discharges. H. Kroemer. *Arch. f. Elektrot*. 29. *pp*. 782–789, *Nov*. 5, 1935.—A continuation of previous work [see Abstract 3962 (1935)]. Cloud tracks of corona discharges were examined by stereoscopic methods. The occurrence of positive space charges in the canals was shown by investigating the deflection due to an electric field. In the case of negative discharge tracks the nature of the surfaces was found to have a marked effect. With different gases the tracks were found to vary in a manner similar to that observed with Lichtenberg figures. A. W.

5144. Sparking Potential of Hydrogen in H.F. Discharge. R. Zouckermann. *Comptes Rendus*, 201. *pp*. 649–651, *Oct*. 14, 1935.—Under similar conditions [see Abstract 3537 (1933)] curves relating sparking potential (V) to pressure (p) were determined for (a) pure H_2 and (b) H_2 containing a trace of Hg vapour. With $\lambda = 101$ m. both curves show a minimum for $V = 342$ volts, $p = 0{\cdot}2$ mm., and are idential for higher pressures, but for lower that for (b) lies above that for (a), while the discharge changes from rose to blue. With $\lambda = 12$ m. the (a) curve has a minimum for $V = 74$ volts, $p = 0{\cdot}002$ mm.; as Hg is admitted the minimum moves towards lower values of V and p. C. A. S.

5145. Mechanism of the H.F. Discharge. H. Beck. *Zeits. f. Physik*, 97. 5–6. *pp*. 355–375, *Oct*. 18, 1935.—In order to elucidate some problems relative to the mechanism of h.f. discharges, optical as well as electrical measurements were carried out. It is shown that, in contradistinction to earlier observations, no difference in spectral intensities can be observed as compared with those given by the positive column of a d.c. discharge. Absorption measurements, again, give the same number of excited states for the h.f. discharge as for the positive column of a d.c. discharge. From this it follows that stepwise excitation cannot be utilised for clearing up the problem of the low ignition potential of the h.f. discharge. The work of Banerji and Ganguli, who applied the Langmuir probe method to the h.f. discharge, is criticised and then a description is given of a probe method suitable for investigating the h.f. discharge. This enables accurate estimation of the electron temperatures to be made. It was found that the electron temperatures in the h.f. discharge agree with those for the d.c. positive column throughout a wide pressure range. The results in general therefore indicate that the mechanism of the h.f. discharge is similar to that of the positive column of a d.c. discharge. A. W.

5146. Kathode Spot Discharge. H. Beck. *Zeits. f. Physik*, 97. 5–6. *pp.* 376–381, *Oct.* 18, 1935.—An account has previously been given of a new type of mercury discharge [see Abstract 2590 (1934)]. Further investigations of this are now described. The current-potential characteristic of the discharge is shown to be divided into a number of segments, the change-over from one segment to the next corresponding to states such that 1, 2, 3, ... kathode patches are stable. A further condition found for the production of the kathode patches is that the surface of the kathode must be electrically pure ; i.e., the surface must have the same work function for every point, as is the case for an oxidisable electrode when covered with a thin film of oxide. It was also found that similar discharges can be obtained in the vapour of Zn or Cd. The effect of transverse and longitudinal magnetic fields on this type of discharge allows conclusions to be drawn as to the mechanism of the discharge, but no reason can as yet be given why such discharges can only be obtained with Hg, Zn and Cd, and not with all gases. A. W.

5147. Simple Derivation of Discharge Current Rules. P. Selényi. *Zeits. f. Physik*, 97. 5–6. *pp.* 395–397, *Oct.* 18, 1935.—In considering the theory of a low-pressure discharge, the system can be regarded as a condenser with the anode as one plate, and the space charge surrounding the kathode as the other. The relation between discharge current, voltage and electrode spacing is given as :— $I = (a/b)(\sqrt{2}/4\pi)\sqrt{(e/m)}E\ /d^2$ where a and b are constants. The proportionality of I and $E^{3/2}$ is well established and may be predicted from a consideration of dimension. In the case of denser gases the formula becomes : $I = (an/4\pi)\ E^2/d^3$ where n is the mobility of the ions formed. J. E. R.

5148. Effect of the Kathode in Limiting and Quenching Discharge. A. J. Nikiforow and T. M. Swiridow. *Zeits. f. Physik*, 97. 5–6. *pp.* 398–401, *Oct.* 18, 1935.—Using a discharge tube with a Hg kathode of small area, the effect of varying kathode conditions on the limiting quenching current of the discharge is investigated. J. E. R.

5149. Negative Glow. W. Weizel and H. Fischer. *Ann. d. Physik*, 24. 3. *pp.* 209–230, *Oct.*, 1935.—Into the negative glow in a hydrogen discharge tube is placed a third electrode, the potential of which can be varied between that of the anode and kathode. Many curves are given showing the relationships between the maintenance potential (V_K), the auxiliary electrode potential (V_H), the tube current (I_K), and the auxiliary electrode current (I_H) for a range of pressures from 0·422 to 2·0 mm. Hg. Curves are also given showing the variation of I_H/I_K with V_H.

The voltage range used was 0 to 1000 V. The potential of the auxiliary electrode can be varied considerably from the anode potential without greatly changing the potential necessary to maintain the tube current. Further lowering of V_H reduces the maintenance potential. In all cases the current to the auxiliary electrode is very considerable. It is shown that if the anode is placed in the negative glow, its potential is lower than that of the glow. When the anode is in this position the anode current is from 10–30 % of the total tube current according to the gas pressure and tube voltage. The same current is observed on the auxiliary electrode if it is isolated in the same position in the discharge. The maintenance potential is lowered more and more, the deeper an electrode (anode or auxiliary) is placed in the glow. The decrease in the maintenance potential varies very little with the potential of this electrode. The phenomena observed are purely diffusion effects and cannot, therefore, be explained by means of the Rogowski theory. J. E. R.

5150. Striation of the Positive Column in the Hydrogen Glow Discharge. H. H. Paul. *Zeits. f. Physik,* 97. 5–6. *pp.* 330–354, *Oct.* 18, 1935.—With a discharge tube containing two probes, one of which is movable along the axis, current-potential characteristics are taken at various positions in the striations of a hydrogen discharge. In the middle of the striations S-characteristics are found corresponding to two groups of electrons of different speed. Experiments with a wall probe and on the appearance of paired striations are described. On the basis of the probe measurements a theory of the striation mechanism in the axial region of the discharge is developed whose essential feature is the assumption of a kind of electrical double layer at the head of a striation originating from the presence of negative ions. The theory is extended to the wall region and the formation of space charges is discussed. It is shown that the various forms of striation can be explained by a varying " ion-mantle " effect. It is also shown that the assumed simple connection between striation form and transverse gradient does not exist. J. E. K.

5151. Estimation of Positive Ion Current from Collector-Characteristics. L. Sena. *Techn. Phys., U.S.S.R.* 1. 5–6. *pp.* 551–554, 1935. *In English.*—Rusk and Peckham's treatment of their own results [see Abstract 4286 (1934)] is questioned: in particular exception is taken to their method of rectilinear extrapolation of the positive ion current. With certain other reservations the experimental results are considered to conform fairly well to modern theoretical conceptions of the gas discharge. F. C. C.

5152. Electron Temperatures in the Positive Column in Mixtures of Neon and Argon or Mercury. H. B. Dorgelo, H. Alting and C. J. Boers. *Physica,* 2. *pp.* 959–967, *Nov.,* 1935. *In German.*—Using a probe electrode measurements were made of the temperature of the electrons in the positive column of a constant current discharge in Ne-A mixtures of constant total pressure (5 mm.). As the proportion of A increased from zero the electron temperature first dropped rapidly and then became practically constant for A contents in excess of 15 %. Additions of small quantities of Hg to Ne were also shown to produce an initial rapid drop in the electron temperature further additions having no effect. The curves of variation of electron temperature with mixture proportions are explained in terms of Schottky's diffusion theory. W. S. S.

5153. Energy of Formation of Negative Ions in O_2. L. B. Loeb. *Phys. Rev.* 48. *pp.* 684–689, *Oct.* 15, 1935.—The attachment of electrons to O_2 molecules is studied. Complicated phenomena reported by earlier workers are explained. Initially electrons are filtered out without ion capture. At higher fields the negative ions break up giving increased capture of carriers. If many free electrons are present at about the first radiating potential in O_2 at high frequencies photoelectrons are liberated and, escaping capture, may cause an increase in the current. At very high fields and higher pressures the electrons ionise by impact, produce a current increase followed by a decline due to capture; an arc then breaks. At pressures of 20 to 60 mm. reattachment masks all the phenomena and a spark breaks shortly after the current rises. The ions break up for ion energies between 0·136 and 0·68 V, the higher being more likely. Since only half is available for electron detachment 0·34 V can be set as the attachment energy upper limit. A. H.

5154. Mechanism of Unimolecular Electron Capture. F. Bloch and N. E. Bradbury. *Phys. Rev.* 48. *pp.* 689–695, *Oct.* 15, 1935.—The formation of negative ions by electron capture in gases in which a dissociation process does not occur is explained by a unimolecular process involving the excitation of molecular vibrational levels and subsequent loss of energy by collision or resonance. In order to obtain a proper order of magnitude to agree with experimental observations, a change of only one vibrational quantum number must be assumed. This sets an upper limit on the electron affinity. For the case of O_2 this limit is 0·17 volt, consistent with other observations. The theory also yields a dependence of the phenomenon on the average energy of the electrons which is in agreement with experiment. [See Abstract 425 (1935).] AUTHORS.

5155. Double Excitation of Helium by Electron Impact. H. S. W. Massey and C. B. O. Mohr. *Cambridge Phil. Soc., Proc.* 31. *pp.* 604–608, *Oct.*, 1935.—The probability of excitation of He by electron impact to the more important doubly excited levels is calculated, and comparison made with the experimental results of Priestley and Whiddington [see Abstract 2682 (1935)] who have observed two lines due to double excitation. The calculated relative intensities and angular distributions are found to be in qualitative agreement with experiment, and reasons are given for the lack of quantitative agreement. AUTHORS.

***5156. Simple Mass Spectrometer. S. H. Bauer.** *J. Phys. Chem.* 39. *pp.* 959–965, *Oct.*, 1935.—A suggestion is put forward for a simple mass spectrometer in which the oscillating field is directly made to be the mass analyser. Certain features of this hypothetical instrument are then discussed from a theoretical viewpoint. A. H.

***5157. Mass Spectrum of Positive Rays from RaC′. L. Wissgott.** *Akad. Wiss. Wien, Ber.* 144. 2*a.* 5–6. *pp.* 227–241, 1935.—Using an improved mass spectrograph with simultaneous electric and magnetic fields, the long-range particles from RaC′ are examined and found to have a specific charge $e/m = \frac{1}{2}$ corresponding to an α-particle. Comparison of the long-range particles with the normal α-particles of range 6·96 cm. at S.T.P. from RaC′ shows the relative intensities to be $25 : 10^6$ in good agreement with an earlier determination of Rutherford. A mass spectrum of natural H-particles was obtained satisfactorily by a special photographic process and it appears that the method may be used to examine the products of nuclear disintegration. F. C. C.

5158. Use of Magnetic Field in Formation of Beams of Ions. A. A. Slutzkin. *Phys. Zeits. d. Sowjetunion*, 8. 3. *pp.* 255–269, 1935. *In German.*—The formation of beams of ions by the focusing effect of mutually perpendicular electric and magnetic fields is examined and the mechanism of the process is explained. Currents of the order of 1 mA were produced, and the possibility of using an aperture to produce stronger current beams was demonstrated. Further applications of the method include the use of the magnetic field as a grid of zero capacity and the functioning of a gasfilled magnetron as a thyratron. F. C. C.

5159. Products and Processes of Ionisation in Methyl Chloride as Determined by a Mass Spectrometer. S. H. Bauer and T. R. Hogness. *J. Chem. Phys.* 3. *pp.* 687–692, *Nov.*, 1935.—The following ions were found to be produced in methyl chloride as primary products: CH_3Cl^+, CH_3^+, CCl^+, CH_2^+, Cl^+, HCl^+, CH^+ and C^+—listed in order of decreasing intensity. Small concentrations of the H^+ ion were also detected. This latter peak was not investigated completely. The appearance potentials for the CH_3Cl^+, CH_3^+ and Cl^+ ions are 11·0, 14·7 and 26 volts, respectively. AUTHORS.

5160. Diffusion of Kathode Rays Examined with Expansion Chamber. I. Günther. *Ann. d. Physik*, 24. 4. *pp.* 377–392, *Oct.*, 1935. —Through an opening of 3 mm. dia. covered with celluloid $0\cdot6\mu$ thick, kathode rays of energies up to 50 kV were introduced into an expansion chamber. The rate of absorption and the fraction diffusing in a backward direction were determined and an analysis was made of the range distribution. Examination of the angular distribution of the end points and of corresponding elementary lengths of the tracks showed results which could be explained on the basis of combined absorption and diffusion. F. C. C.

5161. Gas Reactions in the Silent Discharge at Atmospheric Pressure. Part I. P. A. Thiessen and H. Bartel. *Zeits. f. techn. Physik*, 16. 10. *pp.* 285–293, 1935.—This paper deals with a new kind of screened point discharge with transition from strong to weak current forms, and investigates gas reactions at atmospheric pressure and temperatures above 100° under its influence. The strong current form of discharge resembles a glow discharge at low pressure and reaches from the point to the plate opposite; the characteristic lines during reactions have been measured, and the course of the discharge photographed. For the normal discharge, the screen plate is necessary, but the discharge is independent of the plate dimensions. Blunting the point causes an increase of the current maximum and a diminution of the transition zone. The material of the point is without influence on the phenomena, and, for different metallic kathode plates the characteristic lines are identical. At reduced pressures, the current maximum is higher and the transition zone narrower, while at increasing temperatures the current maximum is higher and the transition zone broader. Simultaneous increase of pressure and temperature appears to favour the production of chemical reactions. Pure gases do not exhibit the phenomena, but mixtures of O_2 and N_2 afford the optimum formation of the characteristic lines at 15 vol. % O_2. The phenomena occur with mixtures of other gases. H. H. Ho.

See also **Abstracts 4777, 4778, 4931, 4949, 4965, 5103.**

CONDUCTION IN SOLIDS AND LIQUIDS.

5162. Energy Bands in Copper. H. M. Krutter. *Phys. Rev.* 48. *pp.* 664–671, *Oct.* 15, 1935.—The general method of obtaining energy bands and wave functions for a face-centred lattice is outlined. The method is applied to a copper lattice using a corrected Hartree potential field. The energy bands as a function of the internuclear distance are calculated. The strong overlapping of the *3d* band and the *4s* band is shown. The assignment of electrons to the lowest energy bands leads to a satisfactory explanation of the well-known fact that copper is a good conductor. The various energy bands of the three directions 100, 110 and 111 are correlated. AUTHOR.

***5163. Semi-Automatic Potentiometer for Thermal Analysis. R. J. M. Payne.** *Journ. Sci. Instruments*, 12. *pp.* 348–355, *Nov.*, 1935.—The paper describes a mechanically driven potentiometer for use in conjunction with an inverse rate recorder for making thermal curves of metals and alloys. The adaptability of the combined instruments to other purposes is considered possible. AUTHOR.

***5164. Inexpensive D.C. Amplifier. R. D. Huntoon.** *Rev. Sci. Instruments*, 6. *pp.* 322–323, *Oct.*, 1935.—The amplifier makes use of a 2A6 double-diode-triode which has the property that the optimum control-grid voltage is nearly equal to the optimum plate voltage divided by the amplification factor. The diode gets current from the same emitter as the triode, so that a modification of the method of DuBridge and Brown and of Soller to overcome changes in emission is possible. The circuit details are given and the method of balancing is discussed. It is stated that, when balanced and shielded and used with a galvanometer of sensitivity 10^{-8} A/mm. a current sensitivity of 3×10^{-13} A/mm. may be obtained. G. E. B.

***5165. Portable L. V. Megohmeter. L. B. Turner.** *Journ. Sci. Instruments*, 12. *pp.* 355–361, *Nov.*, 1935.—A self-contained valve instrument, designed primarily for measuring a wide range of high insulation resistances quickly and without danger of damage in the event of misconnection or breakdown of the insulation under test, is described. Resistance values are scaled directly from 0·07 to 10 megohms, and there are multipliers of 10,100 and 1000 (also 10,000 when an external battery is added). The conditions for ensuring that these multipliers shall be constant throughout the scale are investigated. The same instrument is usable as an a.c. voltmeter reading directly from 0·05 to 3 V at all frequencies. Results of an experimental study of the voltmeter are given. AUTHOR.

5166. Transverse Effects Due to Deformation on the Conductivity of Metals. A. Perrier. *Helv. Phys. Acta.* 8. 6. *pp.* 494–497, 1935. *In French.*—The author discusses (1) the transverse mechano-galvanic effect and subject to confirmation he mentions a mechano-galvanic-thermal effect also ; (2) a longitudinal mechano-thermoelectric effect ; (3) a transverse mechano-thermoelectric effect. The transverse effects of deformation, as also the longitudinal effects, are more allied to elasticity than plasticity. The rôles of elongation and of internal slipping are defined. In all cases the effects observed conform to the theory of spontaneous anisotropy with regard to conduction. The author announces the forthcoming publication of a thermoelectric method for the determination of anisotropy of numerous ferromagnetic bodies, which is simpler and more sensitive than the magnetic method. S. G. B.

5167. Pressure Effect of Electrical Resistance of Metals. N. K. Saha. *Indian Journ. Phys.* 9. *pp.* 623–635, *Sept.*, 1935.—The pressure coefficient of electrical resistance of metals and the change in resistances at different pressures are calculated on the rigid ionic model of Nordheim using a screened Coulombian form of potential. Good agreement is found for Au, Ag, Cu and in general for metals having low compressibility. The results are compared to those obtained by Kroll using Fermi's statistical form of ionic potential. Specific resistance of Au, Ag, Cu, Na, K, Li are also calculated using the two forms of potential on the rigid ionic model. Results on the pressure variation of resistance, and those on the specific resistance are discussed, and it is concluded that the calculation on screened Coulombian potential is more consistent than on Fermi's. Further it is found that for the alkalies which possess very high compressibility neither of the two forms of potential yields any satisfactory result. AUTHOR.

5168. Theory of Electrons in Metals—Supraconductivity. L. Brillouin. *R.G.E.* 38. *pp.* 491–501, *Oct.* 12, 1935.—A general dissertation on supraconductivity. The modern theories of Fermi-Dirac, Sommerfeld and Wiedemann-Franz are discussed and also free electrons in metals and other problems in connection with the structure of metals and alloys. A table of elements which are supraconductors is given, together with their critical temperatures, and also a modified Mendeleieff table in which the supraconductors occur mainly in two groups. The magnetic properties are considered, and, in general, for supraconductivity the magnetic lines flow around the metal, while at high temperatures they pass through undeflected. The relation between thermal and electrical conductivities is given as $X/\sigma T$ = constant, where X and σ are the thermal and electrical conductivities respectively, and T is the absolute temperature. E. H. W. B.

5169. Supraconductivity. H. G. Smith and J. O. Wilhelm. *Rev. Modern Physics*, 7. *pp.* 238–271, *Oct.*, 1935.—A review of the experimental and theoretical contributions which have been made within the last two or three years to the subject of supraconductivity. It is considered that before a complete explanation of these phenomena is available it will be necessary to solve the quantum-mechanical problem in a finite crystal, taking into account electron interactions and lattice vibrations. R. W. P.

5170. Discussion on Supraconductivity and other Low-Temperature Phenomena. *Roy. Soc., Proc.* 152*A*. *pp.* 1–46, *Oct.* 15, 1935.—In the opening address **J. C. McLennan** gave a general survey of the methods of producing low temperatures, and of various phenomena observed in the supraconducting region. **J. D. Cockcroft** described the He liquefaction plant installed by Kapitza, and **D. Shoenberg** described an experiment carried out with its aid to determine the magnetic properties of a supraconducting lead sphere. **W. H. Keesom** referred to several of his recent investigations, including the result that over the range 1·1° K. to 9·0° K. the atomic heat of Ni is 0·001744T. cal./gm. atom greater than the heat capacity of the atomic lattice. He made the suggestion that this additional heat capacity is connected with the energy of the conducting electrons. **N. F. Mott** pointed out that there appeared to be a connection between the excess heat noted by Keesom and the large atomic heat possessed by Ni above the Curie temperature. **W. Meissner** described magnetic effects occurring on transition to the supraconducting state. Experimental results using a hollow cylinder were not completely explained by the assumption of zero permeability in this state, nor did they entirely support the general validity of the hypothesis of Gorter and

Casimir, and the theory of F. and H. London. **R. de L. Kronig** dealt with the propagation of electromagnetic waves in metallic conductors in relation to supraconductivity. **L. Brillouin** discussed difficulties in the interpretation of results obtained in the supraconducting region which have necessitated such theories as those recently suggested by Gorter and London. **N. Kürti** and **F. Simon** gave a brief account of their measurements of the specific heat of iron ammonium alum below 1° K. in connection with a determination of the thermodynamic scale of temperature. **R. Peierls** dealt with thermal conductivity at low temperatures, and also referred to the fact that Debye's law does not hold accurately for the vibrations of the crystal lattice. **F. London** dealt at some length with the macroscopical interpretation of supraconductivity. He agreed with Meissner that the theory implied the existence of electrostatic fields within the supraconductor, but considered that the non-existence of such fields could not be regarded as settled, and experimental tests on this point were in progress. **K. Mendelssohn** described experimental investigations into the induction and energy content in various supraconductive substances, and considered Gorter's ideal model of a supraconductor of zero induction to be realised in pure undistorted single crystals. Results for impure metals and alloys could be explained by assuming their inhomogeniety to cause the formation of a "sponge" of higher threshold value. **J. D. Bernal** remarked on the relationship between crystal chemistry and physics and supraconductivity: and **M. Blackman** considered that theoretical predictions he had made had been confirmed by Keesom's results for the specific heat of KCl. R. W. P.

5171. Supraconductive Alloy in a Magnetic Field. J. M. Casimir-Jonker and W. J. de Haas. *K. Onnes. Lab., Leiden, Comm. No.* 237*C*. *Physica*, 2. *pp.* 935–942, *Nov.*, 1935. *In English.*—A new method for detecting electrical resistance of a supraconductor in a magnetic field is described. The method has been applied to the study of the magnetic transition curve of a Pb Tl-alloy. [See Abstract 1795 (1935).] AUTHORS.

5172. Phase-Equilibrium of Supraconductors in a Magnetic Field. H. London. *Roy. Soc., Proc.* 152*A*. *pp*. 650–663, *Nov.* 15, 1935.—The disturbance of supraconductivity by a magnetic field is treated thermodynamically from the electrodynamic equations of the supraconductor given recently by F. and H. London [see Abstract 1797 (1935)]. It follows that a threshold value of the current density and not of the magnetic field is the decisive quantity. Application to supraconducting regions of small dimensions yields a deviation from Silsbee's relation between magnetic and current-threshold value and leads to the conclusion that the free energy difference between the normal and the supraconducting phase must depend on the dimensions of the supraconductor. This may be interpreted as a surface tension of the supraconducting phase and suggests an explanation of the hysteresis. AUTHOR.

5173. Electrical Resistance of Tantalum Wires Charged with Hydrogen. A. Sieverts and H. Brüning. *Zeits. f. phys. Chem.* 174. *Abt.A*. 5. *pp*. 365–369, 1935.—H_2 absorption and change of resistance were measured simultaneously on a Ta wire at 600°, 500° and 400° C., and at pressures ranging upwards from 1 atmosphere. At 600° and 500° the amount of H_2 absorbed is accurately proportional to the square root of the gas pressure, but at 400° appreciable divergences appear. At 600° and 500° and approximately at 400° the increase in resistance is proportional to the amount of H_2 dissolved. In the region of lower H_2 contents, the same regularities hold for $Ta-H_2$ as for $Pd-H_2$. In both cases, however, their validity extends only so far as the H_2 dissolves without formation of a new phase. T. H. P.

5174. Conductivity of Mesomorphic Substances in the Nematic Phase. M. Jezewski and M. Miesowicz. *Acta Physica Polonica,* 4. 1–2. *pp.* 97–111, 1935.—Investigations were conducted with d.c. and a.c. and included observations of potential and influence of magnetic field. In addition to magnetic and dielectric anisotropy, a constant electric moment is assumed. The conductivity depends upon molecular orientation and friction. F. I. G. R.

5175. Nature of Conductivity of Non-Aqueous Solutions. M. Ussanowitsch. *Acta Physicochimica,* 2. 2. *pp.* 239–271, 1935. *In German.*—The conductivities and temperature coefficients of conductivity were determined for a number of binary systems in which one component was ethyl ether, and in some cases other ethers. The results showed that in all these systems the electrolyte behaved as a chemical combination of the components. It is shown that only those substances which exert an acid function yield conducting solutions with ethers. In the majority of cases of systems containing H_2SO_4, the conductivities are the result of combination of the H_2SO_4 and in a secondary degree upon the component which functioned as the base. In the system HNO_3–H_2SO_4, the HNO_3 functions as the base and in the systems H_2SO_4–$(CH_3)_2SO_4$ and H_2SO_4–CCl_3COOH, where no compounds are formed, a new form of dependence of the conductivity upon the concentration is recognised. It is concluded that the theory of electrolytes must take into account the formation of chemical compounds from the components of the solutions. F. J. B.

5176. Conductivities of Acids and other Solutes in Pyridine. M. M. Davies. *Faraday Soc., Trans.* 31. *pp.* 1561–1567, *Nov.,* 1935.—From conductivity measurements, the following dissociation constants for perchloric, nitric and hydriodic acids in pyridine are determined, $7{\cdot}55 \times 10^{-4}$, $4{\cdot}96 \times 10^{-5}$ and $5{\cdot}9 \times 10^{-4}$, respectively, thus giving a quantitative measure of their relative strengths, and showing that nitric acid is appreciably weaker than the other two in this solvent. Certain "anomalous" electrolytes are also investigated in pyridine. AUTHOR.

5177. Conductivity and Back E.M.F. in Dielectrics. F. Quittner. *Phys. Zeits. d. Sowjetunion,* 8. 3. *pp.* 275–288, 1935. *In German.*—The structure of rock-salt is regarded as consisting of a series of layers of two kinds, each kind having the same dielectric constant, but one kind being thinner and less conducting than the other. Using the values of back e.m.f. and conductivity previously found for rock-salt [see Abstract 591 (1931)], the conductivity of each kind of layer is then determined, and it is shown that the conductivity of both the low- and high-conducting layers increases with increase of voltage gradient. This simple model, however, does not account entirely for the phenomena observed for rock-salt. E. R.

5178. Anomalous Currents in Paraffin Wax. W. Scistowski. *Acta Physica Polonica,* 4. 1–2. *pp.* 123–134, 1935. *In German.*—The currents flowing in thin paraffin wax films are measured at times of 0·01 to 60 sec. after the application of the voltage, and it is shown that up to a voltage gradient of 100 kV/cm., Ohm's law is obeyed. The relation between current (I) and time (t) is $I = At^{-n}$, the value of n being unity when t is greater than 1 sec. and less than unity when t is less than 1 sec. The current flowing during the first second after application of the voltage is not greatly affected by change of temperature between 0° and 40° C., but the currents at greater time intervals increase strongly with increasing temperature. E. R.

See also Abstracts 5137, 5207, 5227.

DIELECTRICS AND CAPACITANCE.

5179. Calculation of Stray Field of a Condenser, the Field being Limited by a Disc. R. Herzog. *Arch. f. Elektrot.* 29. *pp.* 790–802, *Nov.* 5, 1935. *Zeits. f. Physik*, 97. 9–10. *pp.* 596–602, *Nov.* 12, 1935.—The potential and field-strength near a condenser, whose field is limited by a disc, are calculated. The calculations include the extreme cases of a very thick and a very thin disc. Numerical results show that there is little difference between these extreme cases as regards the field behaviour. For the region near the axis of the system, which is of particular interest from the point of view of electron optics, asymptotic formulæ are derived. Calculations are made of the cross-sectional dimensions necessary in a condenser to avoid field inhomogeneity in deflection observations with kathode and canal rays. [See Abstract 3859 (1934).] A. W.

5180. Calculation of Dipole Interaction. R. P. Bell. *Faraday Soc., Trans.* 31. *pp.* 1557–1560, *Nov.*, 1935.—By comparison with a statistical treatment, the method proposed by Martin [see Abstract 4318 (1934)] for calculating dipole interaction is shown to be valid for sufficiently small values of the dipole moment. It should be particularly valuable in concentrated systems where statistical treatment is difficult. AUTHOR.

5181. Rotation of Dipole Molecules in Solid Bodies. J. Frenkel. *Acta Physicochimica*, 3. 1. *pp.* 23–36, 1935. *In German.*—The author commences with a criticism of Fowler's theory [see Abstract 1698 (1935)] and then proceeds to develop a more exact theoretical treatment involving the consideration of rotatory vibrational waves and the rotatory motion of molecules above the transformation temperature. Finally, the basis of the theory of orientation of molecules during fusion is briefly discussed. The paper is mainly mathematical. H. H. Ho.

5182. Dipole Moment of Tetralin. M. A. G. Rau and S. S. Rao. *Indian Acad. Sci., Proc.* 2A. *pp.* 232–235, *Sept.*, 1935.—The moment of tetralin as measured in benzene as solvent is only $0 \cdot 4$ to $0 \cdot 5 \times 10^{-18}$, and not $1 \cdot 66 \times 10^{-18}$ as reported by Puchalik [see Abstract 1294 (1934)]. The origin of this small but finite moment is briefly discussed. AUTHORS.

5183. Dielectric Anomalies of Rochelle Salt. H. Staub. *Naturwiss.* 23. *pp.* 728–733, *Oct.* 25, 1935.—Anomalous electric phenomena of Rochelle salt can be explained, as work done in recent years shows, by the existence of electric dipoles, analogous to the magnetic dipoles of ferromagnetism. The electric dipoles are polarised to saturation by their own field, but in the absence of an external field they compensate one another. An external field sets them all parallel to one another, and thus a large spontaneous polarisation is produced in the direction of the a-axis. This assumption provides an explanation for the high dielectric constant and its dependence on field strength, for the shape of the polarisation-field strength curve and the hysteresis of polarisation, and for other anomalous electric phenomena. P. V.

5184. Dielectric Constants of Gases and Vapours. M. Kubo. *Inst. Phys. and Chem. Research, Tokyo, Sci. Papers, No.* 593. *pp.* 295–304, *Sept.*, 1935. *In English.*—In order to account for the slight increase of molecular polarisation with pressure, as reported by some investigators, the author introduces a correction term to Debye's equation for a gas, which now becomes $P = A + B/T + 3AB^2\rho/8\pi N\beta^3T^2$, where ρ = concentration in mol. per c.c., β = radius of sphere of molecular action, the other symbols having their usual meaning. The third term is obtained by considering the mutual action of dipoles and shows that for non-polar substances, the molecular polarisation is independent of temperature and pressure. This holds for H_2, N_2, CH_4 and air. The slight increase of molecular polarisation with pressure reported for CO_2, which is non-polar, is considered to be due to a factor ignored in the derivation of the above equation. For polar substances, the molecular polarisation at constant temperature should increase linearly with the reciprocal of molecular volume. The results obtained on NH_3 conform to this relation, and the value of the molecular radius calculated from the slope of the straight lines agrees well with that obtained from viscosity measurements and from van der Waals' constant *b*. [See Abstract 3620 (1935).] A. M. T.

5185. Anomalous Dispersion of Polar Solutions with Short Waves. W. Müller. *Ann. d. Physik,* 24. 1. *pp.* 99–112, *Sept.*, 1935.—The dielectric constants of paraffin oil, cable oil, and mixtures of nitrobenzene in paraffin and cable oil are determined at a wave-length of 60 cm. between temperatures of 2° and 40° C. Only the nitrobenzene-cable oil solution shows a dispersion effect at this wave-length. The relaxation time of the nitrobenzene molecule is determined as a function of temperature. The ratio of the viscosity calculated from the Debye formula to the measured viscosity of the mixture is also calculated; it increases strongly with increasing temperature. Measurements on the nitrobenzene-cable oil solution at a wave-length of 500 m. also show the existence of a dispersion region at this wave-length. E. R.

5186. Variation of Dielectric Constant of Water with Extent of Adsorption. G. H. Argue and O. Maass. *Canad. J. of Research,* 13 *Sect.A. pp.* 156–166, *Sept.*, 1935.—An experimental technique is devised for the measurement of the dielectric constants of cellulosic materials containing various amounts of adsorbed water. From measurements made with standard cellulose the dielectric constant of the adsorbed water is calculated over the concentration range 0 to 18 % of water. The dielectric constant of the water initially adsorbed is less than one-quarter of that of liquid water, but it increases with the amount of water subsequently adsorbed, until the dielectric constant approximates that of liquid water as the water content of the fibre approaches the saturation point. These results are shown to be in agreement with the hypothesis concerning the nature of the system cellulose-water. AUTHORS.

5187. Dipole Moments and Structures of Quinoline Derivatives. Catherine G. le Fèvre and R. J. W. le Fèvre. *Chem. Soc., J. pp.* 1470–1475, *Oct.* 1935.—Measurements of the dipole moments of a number of quinoline derivatives are recorded and discussed in relation to the possible influence of substitution on the structure of the quinoline skeleton. T. H. P.

5188. Electric Moments of Organic Compounds. J. N. Pearce and L. F. Berhenke. *J. Phys. Chem.* 39. *pp.* 1005–1010, *Oct.*, 1935.—

The dielectric constants and the densities of dilute solutions of *p*-bromobenzaldehyde, *p*-hydroxybenzaldehyde, *p*-methoxybenzaldehyde, *p*-tolualdehyde, 2-ethylhexanol-1, a-ethylcaproaldehyde, triethanolamine, diethanolamine, and monoethanolamine are measured at 25° C. From these the total polarisation and the dipole moments of each of the compounds are calculated. The spacial orientation of the group moments in the substituted benzaldehydes and in triethanolamine is calculated. The moments of diethanolamine and monoethanolamine calculated from theoretical considerations agree well with the values determined experimentally. AUTHORS.

5189. Dipole Moment and Chemical Structure. M. Puchalik. *Acta Physica Polonica*, 4. 1–2. *pp.* 145–150, 1935. *In German.*—The author first discusses simple structures which possess dipole moments, and arrives at the conclusion that the asymmetric position of the double bonds in isocyclic nuclei is intimately bound up with the presence of a dipole moment. For further illustration of the above relationship, the author has examined cyclopentene and cyclohexene and found them to possess dipole moments of $0\cdot97 \times 10^{-18}$ and $0\cdot92 \times 10^{-18}$ e.s.u. respectively. Further comparisons are made with pyridine and isoquinoline, and with cyclohexene and 1 : 2-dihydronaphthalene. H. H. Ho.

5190. Effect of Magnetic and Electric Fields on Dielectric Constant of Liquids and Gases. A. Piekara. *Acta Physica Polonica*, 4. 1–2. *pp.* 53–64; 73–77, *and pp.* 163–176, 1935. *In French.*—It is shown that the increase of dielectric constant of liquids under the influence of a magnetic field cannot be accounted for entirely by the effect of magnetic saturation. On the assumption that a molecule in a magnetic or electric field acquires an additional electric moment, a mathematical treatment is given, which explains the increase of the dielectric constants of liquids under the influence of magnetic fields, previously observed by the author. [See Abstract 5210 (1934).] This increase is shown to be proportional to H^4. E. R.

***5191. Electrets. A. Gemant.** *Phil. Mag.* 20. *pp.* 929–952, *Nov.*, 1935. *Supplement.*—Various waxes, and compositions made by dissolving certain materials in waxes, can be permanently electrified, as shown by Eguchi, by application of an electric force of the order of 5 to 10 kV/cm. during the process of cooling from a molten state. There are two possible kinds of charges, *viz.*, the heterocharge, which has the opposite sign to the adjacent polarising electrode, is probably caused by ionic space charges, and is of short duration, and the more permanent homocharge, which is of the same sign as the adjacent polarising electrode, and is due to dipole molecules. The dipoles are oriented by the polarising field, and the contraction due to cooling produces a polarisation as in piezoelectric materials. Acidic materials, yielding ions, produce a heterocharge, whereas non-dissociating dipoles, chiefly esters, lead to the steady homocharge. Electrets are the electrical analogues of permanent magnets, and retain their charge if they are kept dry, with their free surfaces short-circuited. Electrometers and electrostatic microphones are possible applications. P. V.

5192. H.F. Dielectric Loss in Liquids. M. Divilkovskij and M. Filippov. *Phys. Zeits. d. Sowjetunion*, 8. 3. *pp.* 311–318, 1935. *In French.*—The thermometric method for the direct determination of h.f. dielectric losses in liquids is applied to ethyl alcohol, propyl alcohol, glycerin and benzene. The power absorbed by the glass of the thermometer is only about 5 % of that absorbed by the liquid and the speed of rise of temperature is very much slower in the glass. The errors likely to occur owing to heat interchange or absorption of the glass are compensated. The values are given in tabular form. It is found that benzene shows no observable loss. The authors indicate the extension of the thermometric method to serve for determination of the electric field and in the case of a mercury thermometer for the assessment of a magnetic field also. It is suggested that the method is suitable for application to the cases where waves of length of several decimetres are employed. S. G. B.

See also Abstracts 4816, 4889, 5138.

ELECTROCHEMISTRY.

5193. Preparation of Oxygen by Electrolysis of Baryta. E. M. Stoddart. *Roy. Soc., Proc.* 152*A*. *pp.* 273–277, *Nov.* 1, 1935.—It is shown that electrolysis of baryta, using Ni electrodes, does not always give pure O_2 at the anode. After some time, H_2 makes its appearance along with the O_2, probably owing to the reaction: $OH + OH = H_2 + O_2$. Liberation of H_2 at the anode can be prevented by coating the electrode with a layer of the black oxide of nickel. AUTHOR.

5194. Statistical Treatment of Strong Electrolytes. S. Levine. *Roy. Soc., Proc.* 152*A*. *pp.* 529–559, *Nov.* 15, 1935.—In this paper, a theory of strong electrolytes is developed by an application of statistical mechanics. The method of Kramers is adopted and it is shown that if the ordinary Coulomb forces between the ions is used, under certain assumptions, his treatment is valid. Owing to his use of a special generalised ensemble, a correction is necessary which is small for low-valency symmetrical electrolytes but which may be quite considerable for the non-symmetrical cases. The deviations from the inverse square law, due to the saturation and hydration effects on the water dipoles and to the polarisation, van der Waals and exchange forces between two typical ions i and j is accounted for by means of a correction term E_{ij} in the expression for their energy of interaction. It is shown that the addition of this term is equivalent to a modification of the dielectric constant D to $D - \delta$, where δ depends on E_{ij} and is a function of the concentration and temperature. The extension in Kramers's theory as a result of this new type of force is given, and it is seen that with the proper form for δ the method proposed here should satisfactorily describe the properties of electrolytic solutions at strong concentrations. Definite numerical results cannot be obtained until δ is known. The attempt has been made to avoid the essential difficulties in the original Debye-Hückel theory. AUTHOR.

5195. Activity Coefficients of HCO_3 Ions. Y. Kauko and J. Carlberg. *Zeits. f. Elektrochem.* 41. *pp.* 721–724, *Oct.*, 1935.—One of the authors (Carlberg) had previously developed a method of estimating CO_2 in the atmosphere, in which the air was passed through a bicarbonate solution and the *p*H value was determined. The CO_2 content was then calculated by the formula: $P = \overline{\overline{H}}.(s + a_1)f_3/C_0 K_s$ where P is the pressure of CO_2 in the atmospheres, $\overline{\overline{H}}$ the activity of the H-ions, S the so-called carbonate alkalinity, $a_1 = \overline{H}^{\cdot} - \overline{OH}'$, C_0 the solubility of CO_2 at 1 atmosphere pressure, K_s the thermodynamic first dissociation constant of carbonic acid, f_3 the activity coefficient of HCO_3-ions. The method is utilised for the critical examination of the activity coefficients recorded for HCO_3-ions. F. J. B.

***5196. Electrolytic Preparation of Deuterium from Heavy Water. F. Norling.** *Phys. Zeits.* **36.** *pp.* 711–713, *Nov.* 1, 1935.—A simple apparatus is described for the preparation of D_2 from D_2O, in which the D_2O is electrolysed under controlled conditions so that exchange reactions between the D_2 and other H_2 and O_2 containing materials is excluded. The apparatus was found to produce D_2 of high purity. The yield was only a few per cent below the theoretical. F. J. B.

5197. E.M.F. Due to Metals Placed in Proximity in Gelatin and Importance of Volta Effect in Cells. Suzanne Veil. *Comptes Rendus,* 201. *pp.* 551–552, *Sept.* 30, 1935.—When wires of Pt and another metal are embedded in gelatin and the other ends are connected to an electrometer the p.d. observed is 1·01, 0·72, 0·59, 0·54, 0·28, and 0·22, according as the second metal is respectively Zn, Cd, Fe, Pb, Ni or Cu. If it be Ag or Au the p.d. is negligible. With Al there is no result owing to the coating of oxide. The magnitude of this p.d. suggests that the Volta effect should not be neglected in ordinary cells. The differences with different metals are so marked that they should be capable of forming the basis of a method of determining the constituents of alloys. C. A. S.

***5198. Adsorption Electrodes. Part II. Mineral Electrodes. H. J. C. Tendeloo.** *K. Akad. Amsterdam, Proc.* 38. 4. *pp.* 434–441, 1935. —Minerals in the form of thin plates may be used as electrodes. It is anticipated that, on further perfection of the methods, it will be possible to determine electrometrically activities of ions which have thus far been inaccessible, and further to elucidate the structure of the electrical double layer of minerals and the exchange of ions. [For Part I see Abstract 2637 (1934).] AUTHOR.

5199. Measurement of Activity of Barium Ions in Aqueous Solutions by Barium-Amalgam Electrode. Z. J. Berestnewa and V. A. Kargin. *Acta Physicochimica,* 2. 2. *pp.* 163–170, 1935. *In German.* —A new art has been worked out for the Ba-amalgam electrode. The potentials have been measured in pure $BaCl_2$ solutions from 1·0 to 0·001 *N*. It is shown that the presence of Na-ions in solutions at concentrations up to 0·1 *N* has no influence on the potential. The possibility of applying this electrode to determine the activity of Ba-ions in aqueous solutions is demonstrated. J. K.

5200. Electrode Potentials of Sodium and Potassium in Liquid Ammonia. W. A. Pleskow and A. M. Monossohn. *Acta Physicochimica,* 2. 5. *pp.* 615–620, 1935. *In German.*—The electrode potentials of Na and K in liquid NH_3 were determined by means of amalgam electrodes. Contrary to the potentials in the usual elements, it was shown that the potentials of Na and K suffered a displacement on a positive direction. Consequently the potentials of Na and K in liquid NH_3 are appreciably closer and the H_2-potential than in water. This fact apparently accounts for the stability of solutions of the alkali metals in liquid NH_3. F. J. B.

5201. Electrode Potentials in Water and Liquid Ammonia. W. A. Pleskow and A. M. Monossohn. *Acta Physicochimica,* 2. 5. *pp.* 621–632, 1935. *In German.*—A method of comparing the electrode potentials in water and in liquid NH_3 is described. The method depends upon the measurement of the potential of a drop electrode. The potentials of a Hg-drop electrode were determined in solutions of NH_4NO_3 in liquid NH_3 and in mixtures of water and NH_3. Values for the electrode potentials of K, Na, Zn, Cd, Pb, H_2, Cu, Ag and Hg in liquid NH_3 were obtained, referred to the potential of the H_2-electrode in water. F. J. B.

5202. Electrode Potentials of the Halogens in Liquid Ammonia. W. A. Pleskow. *Acta Physicochimica,* 2. 6. *pp.* 679–688, 1935. *In German.*—It is shown that in the calculation of the normal potentials of the halogens in liquid NH_3, the free energy of formation of the crystal solvate must be taken into account. The method of calculation is described with particular reference to solutions of ammonium salts. F. J. B.

5203. Calculation of Electrode Potentials. S. Makishima. *Zeits. f. Elektrochem.* 41. *pp.* 697–712, *Oct.,* 1935.—A cycle of operations is utilised to calculate the normal potentials of the various elements. In the case of a metal electrode, the cycle is the vaporisation of one molecule of the metal. The vapour in the gas space is then ionised, the gaseous ions are then dissolved in the solvent and finally the solvated ions returned to metal at the electrode, by the electrode reactions. Further, a cyclic process is evolved which yields a formula for the connection of the solubility product of a salt with its heat of solution, ionic entropy, etc. The values calculated and observed for the normal potentials are in good agreement. F. J. B.

5204. Electrochemical Properties of an Element and Its State of Aggregation. O. Stelling. *Zeits. f. Elektrochem.* 41. *pp.* 712–721, *Oct., and pp.* 779–789, *Nov.,* 1935.—The electrode potentials of Ga and Ga-amalgams in solutions of Ga salts were determined. The measurements were made in the temperature range of the melting point; the behaviour of supercooled liquid electrodes and the crystallisation changes were also investigated. The dependence of the kathode and anode potentials on temperature in the electrolysis of solutions of Ga salts, and the dependence of the H_2- and metal-overvoltages on temperature were also studied. Experiments were also made to study the behaviour of alloy electrodes and the electrolytic formation of alloys by the use of Ga kathodes in comparison with the Hg electrodes. The polarisation of Ga electrodes during deposition and solution and its dependence upon temperature near the melting point were studied with kathodes of Hg, Pt and Ga. The electrolytes were solutions of GaCl containing HCl, and in some cases NaCl. The form of the potential-current density curve was shown to depend upon the state of aggregation of the Ga on the kathode. F. J. B.

5205. Electrode Polarisation in Deposition of Metals from Complex Cyanide Solutions. O. Essin and A. Matanzew. *Zeits. f. phys. Chem.* 174. *Abt.A.* 5. *pp.* 384–394, 1935.—The experimental results of S. Glasstone were examined, and it was found that the concentration polarisation accompanying the accumulation of CN ions at the kathode, led to a relationship between the polarisation and the current density, which was exactly analogous to the equation for the H_2-overvoltage. In the case of the deposition of Hg from cyanide solution, this peculiarity can be treated as chemical polarisation which, owing to the delayed discharge in the sense of the Volmer theory, is related to the overvoltage. The experimental results did not yield definite results in the case of the deposition of Ag and Cd. In the case of Cu, no polarisation took place so that a depolarising action had to be assumed. F. J. B.

5206. Electrode Dispersion of Noble Metals. A. Voet. *Faraday Soc., Trans.* 31. *pp.* 1488–1491, *Nov.,* 1935.—On electrolysing with electrodes of noble metals with a high current density and a high p.d., not only in alkaline, but also in acid and neutral solutions, a disintegration of the anode is observed from which generally unstable suspensions result. Every electrode dispersion is accompanied by frequent pulsations of the current. To obtain electrode disintegration, for every p.d. a minimum concentration of the electrolyte is required. The Wehnelt effect is not the cause of the electrode dispersion. The electrode dispersion may be explained as the result of the repulsion of a periodically formed " oxide " layer on the surface of the anode. AUTHOR.

5207. "Salting-In" of Hydrogen Peroxide by Electrolytes. M. H. Gorin. *Am. Chem. Soc., J.* 57. *pp.* 1975–1978, *Oct.*, 1935.—Data are given and plotted for the distribution ratio and activity coefficients of H_2O_2 between solutions of the chlorides and nitrates of Na, K, and NH_4, and of NH_4ClO_4 and H_2SO_4 in either isoamyl alcohol, or an acetophenone-CCl_4 mixture, or both. The activity coefficient is less than unity in all the solutions studied, except that of H_2SO_4. The order for salting in of H_2O_2 by negative ions is the same as the order for the salting out of non-electrolytes in general. The behaviour of H_2O_2 in solutions of electrolytes differs from that of other non-electrolytes and requires that the H_2O_2 molecule tend to displace water molecules surrounding all ions. The bearing of the results on the structure of the H_2O_2 molecule is discussed. N. M. B.

See also Abstracts 4786, 4792, 4805, 5081, 5097, 5117.

ELECTRONS, POSITRONS AND PROTONS, INCLUDING APPLICATIONS.

5208. Scattering of Slow Ions by Metals and Measurement of Threshold Scattering Potentials. H. Lüder. *Zeits. f. Physik,* 97. 3–4. *pp.* 158–170, *Oct.* 11, 1935.—Using very high discharge current densities, ions of argon and alkali metals were directed perpendicularly against metal scattering electrodes, and the intensity of the scattered ion current was measured. Curves are given showing the variation of scattering with ion velocity in the range 0–120 volts. The velocity of the ions was measured by the retarding field method. Owing to the low velocity of the ions used it is possible to extrapolate the curves to find the threshold scattering potential. For A^+ ions the values found are for Ni 7, Cu 12, Fe 14 and W 24 volts. When alkali metal ions were used it was necessary to introduce a heated target to avoid condensation of the ions. The threshold values obtained were K^+ on W 36, Cs^+ on W 15, Li^+ on W 80, and Cs^+ on Cu 15 volts. The measured threshold potentials were compared with the theoretical predictions of Holst and of Langmuir. In general the experimental values are somewhat higher than those predicted by Holst, but are much lower than those of Langmuir. J. E. R.

5209. Scattering of Slow Electrons from Thin Metal Foils. H. W. Langenwalter. *Ann. d. Physik,* 24. 3. *pp.* 273–296, *Oct.*, 1935.—Experiments are described in which thin sheets of Ag, Pt and Pd are bombarded with slow electrons (< 100 V) at an angle of 70° to the normal. The velocity distribution of the electrons emitted normally from the metals was investigated by means of the Lenard-Becker retarding field method. The material of the reflecting surface appears to have no marked effect on the shape of the curves. Unheated metal sheets show two widely separated groups of reflected electrons, one consisting of full velocity electrons, and the other of retarded electrons. There is no evidence of energy losses of the order of 1 V. The proportion of elastically reflected electrons increases with decreasing primary velocity. The observed slow group of electrons consists of secondary electrons, mostly in the 2–3 V range. Heating of the metal foils causes the complete disappearance of the gap between the groups of scattered electrons; this effect is not reversible when the reflector is allowed to cool. When pure H_2 is occluded in the Pt and Pd, the effect on the shape of the curves is similar to, though less pronounced than that of heating. Previous work on the subject is discussed at some length and an extensive Bibliography is included. J. E. R.

5210. New Interference Pattern by Passage of Fast Electrons through Crystals. F. Kirchner and H. Lassen. *Ann. d. Physik*, **24.** 2. *pp.* 113–126, *Oct.*, 1935.—Using a crystal interference grating of a thin layer of silver crystals on a rock-salt base, the reflection of electrons gave a number of interference points lying on curves. The results are explained on the basis of surface lattice interference produced by the octahedral planes of a large number of small crystals similarly orientated. With thicker layers the interference curves disappear and the pattern assumes the appearance as for a large crystal. F. C. C.

5211. Electron Diffraction by Rubber Films. K. I. Krylow. *Phys. Zeits. d. Sowjetunion.* **8.** 2. *pp.* 136–152, 1935. *In German.*—Passage of electrons through a thin film of natural rubber gives rise in general to a diffraction ring corresponding to an isotropic structure. If the film is stretched, a point interference pattern is obtained as with X-rays. The position of most of the interference points is accounted for by the model suggested by Susich, Mark and Meyer on the basis of X-ray analysis, but the explanation of a few of the points requires a modified model. Strong cooling produces a sharp interference pattern which is attributed to the formation of orientated crystallites. Synthetic chloroprene rubber gave a point interference pattern produced by orthorhombic units with axes $a = 10 \cdot 93$ Å and $b = 8 \cdot 23$ Å, the corresponding values for natural rubber being $a = 12 \cdot 3$ Å and $b = 8 \cdot 3$ Å. No point interference pattern has hitherto been obtained for sodium " butadien " rubber, but this is attributed to the difficulty in obtaining a thin film of the substance and is not taken to indicate an entirely different structure from that of chloroprene or natural rubber. F. C. C.

5212. Electron Diffraction by Metals and Organic Polymers. J. J. Trillat and H. Motz. *Ann. de Physique*, **4.** *pp.* 273–304, *Oct.*, 1935.—A connected account of much previous work (33 references) with amplifications showing that the identical electron diffraction patterns given alone or with specific patterns by metals, some oxides, etc., unless very perfectly cleaned, or by many organic substances (nitro- and acetylcellulose, resins, etc.) are due to uni- or bi-molecular layers of some aliphatic compound (paraffin, monobasic fatty acid, wax, etc.) oriented with the length of the molecule perpendicular (in the case of the fatty acids also) to the support. The patterns due to this fatty layer on a cellulosic support appear much more slowly if this support is thicker or contains unesterified hydroxyl groups, indicating delayed crystallisation. Prolonged irradiation (15–30 min.) with the electron beam destroys the fatty layer. [See Abstract 2421 (1935.] C. A. S.

5213. Electron Diffraction Pattern from the Natural (111) Face of Diamond. R. Beeching. *Phil. Mag.* **20.** *pp.* 841–855, *Nov.*, 1935.—Intensity measurements have been made on the electron diffraction pattern obtained from a (111) face of diamond. The relative intensities of the main spots have been determined and the tolerances in the Bragg angles have been compared with the widths of the corresponding Kikuchi lines. The inner potential has been measured and various qualitative observations have been made. A case where a spot has been partially suppressed by Kikuchi lines is recorded. AUTHOR.

5214. Electron Diffraction by Gases. L. R. Maxwell, S. B. Hendricks and V. M. Mosley. *J. Chem. Phys.* 3. *pp.* 699–709, *Nov.*, 1935.—The method of electron diffraction is used for determining the C – O – C valence angle (α) in 4,4′ diiododiphenyl ether $[(C_6H_4I)_2O]$ and the molecular structures of phosphorus (P_4) and arsenic (As_4). The electron diffraction photographs are analysed by four different methods as follows: (1) Visual measurements, (2) measurements of densitometer records, (3) conversion of densitometer records into relative intensity curves, (4) comparison of transformed intensity curves obtained by multiplying the intensity of scattering by $[(1/\lambda)\sin\theta/2]^2$ which produces prominent maxima for measurement. The valence angle α is found to be $118 \pm 3°$ for 4,4′ diiododiphenyl ether, definitely greater than the oxygen valence angle found for simpler types of molecules. P_4 and As_4 are found to have a regular tetrahedral structure within the limits of experimental error, the atomic separations being 2·21 Å and 2·44 Å, respectively. [methods (1) and (2) were used for the case of arsenic]. The minimum atomic distances as found by crystal structure analysis for P and As are approximately the same as the atomic separations obtained for the gas molecules, showing in addition that these distances do not change greatly when the bond angle decreases from 100° to 60°. AUTHORS.

***5215. Electron Diffraction Camera. R. Morgan and N. Smith.** *Rev. Sci. Instruments*, 6. *pp.* 316–319, *Oct.*, 1935.—The construction of a simple electron diffraction camera which can be used with reflection and transmission specimens and with gases and vapours is described. Special features are the use of a heavy anode to avoid cooling devices, electrostatic fields for focusing and sylphon bellows in place of stopcocks and ground joints. F. C. C.

5216. Collisions of Slow Electrons with Methane Molecules. H. L. Brose and J. E. Keyston. *Phil. Mag.* 20. *pp.* 902–912, *Nov.*, 1935. *Supplement.*—The effective cross-section Q of CH_4 molecules with respect to electrons of from 0·3 to 1·7 $\sqrt{V}$ velocity is measured with a Townsend diffusion apparatus. The cross-section is found to pass through a minimum of 4·76 $cm^2./cm^3.$ at a velocity of 0·5 $\sqrt{V}$ in good agreement with Ramsauer and Kollaths observation of a minimum of 4·7 $cm^2./cm^3.$ at a velocity of 0·6 $\sqrt{V}$. The measurements permit the calculation as a function of electron velocity of λ, the average fraction of its energy which an electron loses in collisions with CH_4 molecules. λ is found to be greater for CH_4 than for any other gas previously investigated, and since the smallest measured values of λ are those of A it follows that the similarity of the $Q/\sqrt{V}$ curves of CH_4 and A noted by previous investigators is entirely fortuitous and not as assumed by those investigators indicative of close structural similarity between the CH_4 molecule and the A atom. The maximum found in the $\lambda/\sqrt{V}$ curve corresponds with the strongest infra-red absorption bands of CH_4. There is general similarity between both $Q/\sqrt{V}$ and $\lambda/\sqrt{V}$ curves of CH_4 and C_5H_{12}. J. E. K.

5217. Sudden Changes in Energy of Electrons of Great Energy. L. Leprince-Ringuet. *Comptes Rendus*, 201. *pp.* 712–714, *Oct.* 21, 1935.—With the same arrangement [see Abstract 2739 (1935)] save that filtration was through 15 cm. Pb, some 2000 photographs were taken. Of the tracks observed four are considered to indicate production of electron pairs, and fifteen nuclear collisions, or about ten times the theoretical number. With interposition of a Pb screen 0·1 mm. thick in the chamber some 60 tracks were observed, indicating losses of energy due to nuclear collisions numbering some 5 to 10 times theoretical. In both cases about 16 % of the electrons were positive, and the energies of these support the view that they result from formation of electron pairs by materialisation of photons from Th C$''$. C. A. S.

5218. Creation of Electron-Pairs by Fast Charged Particles. H. J. Bhabha. *Roy. Soc., Proc.* 152*A*. *pp.* 559–586, *Nov.* 15, 1935.—The creation of electron pairs in the collison of particles moving with relative velocity very near the velocity of light is calculated. The effect of screening is considered, and the variation of probability of pair creation as function of impact parameter is investigated. It is shown that to a certain approximation most of the formulæ can be derived by a method similar to one due to v. Weizsäcker, where the field of the moving particle is considered as a superposition of γ-rays [see Abstract 2876 (1934)]. The effective cross-section for the pair creation by fast protons in lead is more than a thousand times larger than the cross-section for pair-creation by slow protons calculated by Heitler and Nordheim. For the collision of electrons of 10^8 eV, with a lead nucleus, the cross-section is of the order 10^{-24} cm^2., and is about one-fifteenth of the cross-section for the creation of a pair by a γ-ray of the same energy. It increases with increasing energy of the electron. AUTHOR.

***5219. Ion-Optical Image Formation with Electric Lenses. J. Koch and W. Walcher.** *Zeits. f. Physik*, 97. 3–4. *pp.* 131–137, *Oct.* 11, 1935.—An electrical and magnetic lens system is employed to form images of a series of holes in a metal diaphragm and of a surface emitting ions using K ions. The apparatus is almost identical in construction with the electron microscope and the images obtained are compared with those given by the latter. H. J. H. S.

***5220. Theory of Image Defects in an Electron Microscope. W. Glaser.** *Zeits. f. Physik*, 97. 3–4. *pp.* 177–201, *Oct.* 11, 1935.—The analysis already described [see Abstract 629 (1934)] is applied to a study of the coma, spherical aberration and distortion of an electromagnetic lens system. The theory of higher approximations is discussed and expressions are derived for the Seidel formulæ and Petzval curvature. H. J. H. S.

See also Abstracts 4753, 4756, 4774, 4974, 5154, 5155, 5179.

ELECTROSTATICS.

5221. Two-Dimensional Distributions of Electricity. E. P. Adams. *Am. Phil. Soc., Proc.*, 75. 6. *pp.* 549–563, 1935.—A paper giving expressions for the distribution of electricity on conductors of various geometrical formations. Schwarz-Christoffel transformations are used and the paper is entirely mathematical. [See also Abstract 4388 (1935).] E. H. W. B.

See also Abstracts 4880, 5191, 5197, 5251.

GALVANOMAGNETIC AND THERMOMAGNETIC EFFECTS.

5222. Variation of Resistance of Bi Crystals in Magnetic Fields at Low Temperatures. W. J. de Haas, J. W. Blom and L. Schubnikow. *K. Onnes Lab., Leiden, Comm. No.* 237*b*. *Physica*, 2. *pp.* 901–914, *Nov.*, 1935. *In German.*—A former paper by the authors gave the resistance of pure Bi in the temperature range of liquid hydrogen, 14·15° K., when under the influence of a magnetic field of about 23 kilogauss as being more than 6000 times as great as the resistance without field influence at 0° C. Its resistance at the temperature 14·15° K. is only 0·024 of that at 0° C., and therefore the superposition of the magnetic field as above increases it about 250,000 times. In the present work the values were obtained in the temperature range of liquid He, and the following results were established: (1) The influence of the magnetic field is greater at 4·22° K. than at 14·15° K., and at 1·35° K. is exactly the same as at 4·22° K. (2) The relationship of the resistance of a single crystal (current parallel to main axis, and perpendicular to lines of force) to the orientation of the axes in regard to the lines of force, is more complicated at 1·35° K. than at 14·15° K. S. G. B.

5223. Change of Resistance of Single Crystals of Gallium in a Magnetic Field. Part III. W. J. de Haas and J. W. Blom. *K. Onnes Lab., Leiden, Comm. No.* 237*d. Physica,* 2. *pp.* 952–958, *Nov.,* 1935. *In English.*—The change of the resistance of single crystals of pure Ga (which had the pseudo-tetragonal axis parallel to the length of the wire) in a magnetic field perpendicular to the wire is measured at liquid helium temperatures. (1) At 4·22° K. the increase of the resistance is larger than at liquid hydrogen temperatures. (2) At 4·22° K. and 1·35° K. the increase is nearly the same. (3) The separation of the secondary maxima and minima in the rotational diagrams is larger at liquid helium temperatures. [For Part II see Abstract 2647 (1934).] AUTHORS.

See also Abstracts 5171, 5172.

MAGNETISM AND ELECTROMAGNETISM.

5224. Refinement of the Heisenberg Theory of Ferromagnetism Applicable to Simple Cubic Crystals. C. H. Fay. *Nat. Acad. Sci., Proc.* 21. *pp.* 537–542, *Sept.,* 1935.—A refinement of Heisenberg's theory is developed in which the micro-crystal is regarded as built up of units larger than the atom but containing sufficiently few atoms to permit calculation of their unperturbed energy levels, and in which the coupling energies between these units for states of spin, S′, are replaced by the average coupling energy for S′. The method is applicable most readily to cubic crystals, and treats half of the atomic interaction rigorously (instead of none as previously), the remainder being treated by an average energy approximation as in the simple theory. The results suggest that the simple theory is preferable to Heisenberg's modification of it in which a Gaussian distribution of the energies is considered. J. S. G. T.

5225. Field Acting in the Interior of Ferromagnetic Bodies. A. Carrelli. *N. Cimento,* 12. *pp.* 337–341, *June,* 1935.—Referring to Weizsäcker's results [see Abstract 4481 (1933)] as to the value of the field acting upon a moving electrified particle in the interior of a ferromagnetic substance, it is shown that there is an uncertainty in the deduction. Theory shows that this field may be the vector intensity of magnetisation, and the behaviour of ferromagnetic substances in magneto-optic phenomena and in the Hall effect indicates that this is the case. J. J. S.

5226. Theory of the Dispersion of Magnetic Permeability in Ferromagnetic Bodies. L. Landau and E. Lifshitz. *Phys. Zeits. d. Sowjetunion,* 8. 2. *pp.* 153–169, 1935. *In English.*—The distribution of magnetic moments in a ferromagnetic crystal is considered. The case of a crystal with one principal axis which is the axis of easiest magnetisation,

such as a crystal of Co with its hexagonal axis, is discussed; but the results apply to any body with one direction of easiest magnetisation. It is found that such a crystal consists of elementary layers magnetised to saturation, and the width of these layers is determined. In an external magnetic field the boundaries between these layers move, and the velocity of this motion is determined. The magnetic permeability in a periodic field parallel and perpendicular to the axis of easiest magnetisation is found.
J. J. S.

5227. Fe-Ni-Cu Alloys. W. Köster and W. Dannöhl. *Zeits. f. Metallkunde*, 27. *pp.* 220–226, *Sept.*, 1935.—A detailed account of the thermal, magnetic and electrical properties of Fe-Ni-Cu alloys, summarising much previous work (20 references) and the examination of 78 different alloys. Results are given in 28 diagrams. The chief points brought out are: (*a*) That the α/γ transformation is limited to the Fe side of a line joining the point for Fe : Ni = 72 : 28 to that for pure Cu on the triangular diagram; and (*b*) that the amount of Ni required to effect complete miscibility of Fe and Cu decreases from 82 % at the ordinary temperature to 27 % at 1220°. It is suggested that the different amount of Ni found in (*b*) from that found by others is due to presence of other metals, *e.g.*, Mn. Relations between hardness and permeability, and between lines of maximum permeability and conodes (deduced from the Curie points for lower, and from lines of equal electric resistance at higher temperatures) are discussed. [See Abstract 3658 (1935).]
C. A. S.

5228. Paramagnetism of Metallic Gadolinium above its Curie Point. F. Trombe. *Comptes Rendus*, 201, *pp.* 652–653, *Oct.* 14, 1935.—The curve relating $1/\chi$ (χ = specific susceptibility) to temperature between 16° and 360° is curved below 90°, a straight line above. At 27·4° $\chi = 4797 \times 10^{-6}$. The paramagnetic Curie point is at 29·5°, the ferromagnetic at 16°; the paramagnetic moment, calculated by Langevin's formula is 39·28 Weiss magnetons, the theoretical value for the Gd^{+++} ion being 39·26.
C. A. S.

5229. Effect of Crystalline Fields on the Magnetic Susceptibilities of Sm^{+++} and Eu^{+++}, and the Heat Capacity of Sm^{+++}. Amelia Frank. *Phys. Rev.* 48. *pp.* 765–771, *Nov.* 1, 1935.—The temperature variation of the paramagnetic susceptibility of Sm^{+++} is calculated on the assumption that the ion is subject to a crystalline field which can be represented by the potential

$$V = \sum_i [D(x_i^4 + y_i^4 + z_i^4) + Ax_i^2 + By_i^2 - (A + B)z_i^2],$$

the cubic portion of this potential predominant. The susceptibility is decreased by about 25 % with respect to that of the free ion at 74° K. when the cubic potential is so chosen as to give a separation of the $J = 5/2$ levels of about 200 cm^{-1}. which is of the order indicated by Spedding's work on the absorption spectrum of Sm compounds. The theoretical values of the susceptibility are then in satisfactory agreement with the experimental data of Freed over a temperature range from 74° K. to room temperature. The rhombic portion of the field separates the lowest excited level into two but the contribution to the susceptibility is negligible if the rhombic separation is small compared with the cubic separation. In striking contrast with Sm^{+++}, Eu behaves like the free ion even in the presence of a crystalline field. The contribution to the heat capacity of Sm^{+++} at various temperatures due to the excited levels is computed. When the levels which give good agreement with susceptibility data are used, the general shape of the curve is the same as that obtained experimentally by Ahlberg and Freed but the theoretical values are consistently lower than the experimental values. AUTHOR.

5230. Diamagnetism of Copper. S. R. Rao. *Indian Acad. Sci., Proc.* 2*A*. *pp*. 249–259, *Sept.*, 1935.—Colloidal copper is prepared by an electrical dispersion method, the dispersing medium being benzene or propyl alcohol. The particles are prevented from contact with air by conducting the dispersing and centrifuging experiment *in vacuo*. The diamagnetic susceptibility (χ) of the samples is determined by a sensitive Curie method. The value for copper *en masse* is 0·080. The χ value increases as the size of the particles is reduced, the critical diameter below which large changes occur being 0·8 μ. Honda and Shimizu have shown that cold-working in the case of copper gives rise to increased diamagnetism, and suggest the analogy between cold-working and colloidalisation. These conclusions are verified. The thickness of the surface layer appears to be about 300 Å and its diamagnetic susceptibility 0·200. On the basis of the theory of Honda and Shimizu, the density of the superficial layer is 8·404 as against 8·943 for the mass metal. Attention is drawn to the work of Thomson [see Abstract 955 (1932)] on electron diffraction from electrolytic copper, wherein larger lattice constants were obtained for surface layers. AUTHOR.

5231. Diamagnetism of Alkyl Acetates. D. B. Woodbridge. *Phys. Rev.* 48. *pp*. 672–682, *Oct.* 15, 1935.—Susceptibility measurements on the first five primary alkyl acetates and on methanol, made with the manometric balance of Wills and Boeker over the range 5°–70°, are described. The results show a very slight variation of susceptibility with temperature and an indication of increasing temperature dependence for higher members of the acetate series. The molecular susceptibility of CH_2 is found to be additive in agreement with Pascal's law. The magnetic properties of $NiCl_2$ solutions are discussed with special regard to the work of Fahlenbrach [see Abstract 5264 (1932)] and experiments on $NiCl_2$ solutions as used for calibrating the manometric balance are described. No variation in the calibration depending on the method of preparing the solutions was found. AUTHOR.

5232. Diamagnetic Study of Structure. F. W. Gray and J. H. Cruickshank. *Faraday Soc., Trans.* 31. *pp*. 1491–1510, *Nov.*, 1935.—Two existing diamagnetic standards (Pauling's theoretical and Pascal's experimental) are shown to be reconcilable, and their usefulness is enhanced and demonstrated in a diamagnetic study of structure by a new plan, linking up diamagnetism with dipole moments and other properties, and applicable to a wide range of problems. For benzene, naphthalene, acid carboxyl group, water and hydrogen peroxide, structures are given showing close quantitative agreement with diamagnetic data. The present plan differentiates precisely between different structures, including those involving resonance, and is applicable to cases for which no method has hitherto been available. Incidentally, an interpretation is given showing the theoretical significance of Pascal's rules obtained by him empirically. AUTHORS.

5233. Diamagnetic Susceptibilities of Salts Forming Ions with Inert Gas Configurations. Part II. Halides of Li, Rb and Cs. G. W. Brindley and F. E. Hoare. *Roy. Soc., Proc.* 152*A*. *pp*. 342–353, *Nov.* 1, 1935.—Experimental results are given for the halides of Li, Rb and Cs and are compared with those obtained for halides of Na and K [see Abstract 5253 (1934)]. For LiCl, LiBr, LiI, CsCl, CsBr and CsI, the diamagnetic susceptibilities are not additive, but for the remaining salts of the series the additivity law holds within the limits of experimental error. The departures from additivity are considered in relation to similar results for ionic packing sizes. It is suggested that the low susceptibilities of the Li and Cs chlorides, bromides and iodides are due to deformations of the ions produced by (*a*) the unusually close approach of the negative ions in LiCl, LiBr and LiI and (*b*) the change of crystal structure in CsCl, CsBr and CsI. A series of ionic susceptibilities is derived for ions in crystals of the rock-salt type in terms of $Li^+ = 0 \cdot 7 \times 10^{-6}$. T. H. P.

5234. Algebraic Electrodynamics. L. Flamm. *Akad. Wiss. Wien, Ber.* 144. 2*a*. 5–6. *pp*. 243–261, 1935.—It is shown that, by introducing the Lorentz velocity for an electron in an electric field and an analogously defined velocity in a magnetic field, it is possible to transform Maxwell's electromagnetic field-equations from differential into algebraic equations. Application of the transformed equations is made to the theory of the reflection, refraction, etc., of electromagnetic waves. G. C. McV.

5235. Gyromagnetic Effect in Pyrrhotin. F. Coeterier. *Helv. Phys. Acta*, 8. 7. *pp*. 522–564, 1935. *In German*.—The assistance of known magnetic rotatory effects is sought to determine the mechanical drag or attraction forces on the magnetic moment. After a review of the history of such work the author describes both with theoretical and practical details the method he has developed for this purpose. The method of Einstein and de Haas is utilised with suitable adaptations and the material is contained in small glass tubes. When the *g*-value is determined for pyrrhotin in order to discover a suitable atomic model, the result is about 0·63 to 0·66. The most potent conclusion to be drawn from the work is that the path-moment of the electrons plays a part in the ferromagnetism of the crystals in the hexagonal chief plane. The two types of pyrrhotin measured showed no appreciable difference in the results obtained. S. G. B.

5236. New Method for Constitution Diagrams. G. Grube. *Zeits. f. Metallkunde*, 27. *pp*. 194–195, *Sept*., 1935.—A method is described by which constitution diagrams can be investigated by measuring the magnetic susceptibilities of alloys at different temperatures. J. T.

See also Abstracts 4824, 4859, 4870, 4984, 5170.

MEDICAL RADIOLOGY AND ELECTROLOGY.

5237. Stereoröntgenometry. C. R. Johnson. *Radiology*, 25. *pp*. 492–497, *Oct*., 1935.—The principles of stereometric measurements are briefly discussed, based upon the cross-thread method first used for X-ray localisation by Mackenzie-Davidson. From a pair of stereographic radiographs the spatial relationships of any part of a radiograph can be determined and a model constructed. Applications are described. B. J. L.

5238. Daphnia Magna as a Biological Dosimeter for Soft X-Rays. H. Kersten and G. C. Snider. *Radiology*, 25. *pp*. 285–288, *Sept*., 1935. —The animal *Daphnia Magna*, is suggested for use for biological determination of X-ray dosage, particularly as the internal organs are easily visible and death, after irradiation, is easily determined. The method of culture and method of determination of dosage is illustrated and the method has the advantage that the dose, particularly in respect to soft X-rays, is immediately determined after irradiation. B. J. L.

5239. 800-kV X-Rays in Radiation Therapy. H. Schmitz. *Radiology*, 25. *pp.* 341–348, *Sept.*, 1935.—Since early in 1933 an 800 kV cascaded Coolidge tube apparatus has been operated at the Mercy Hospital, Chicago. Since modification, in September, 1933, there has not been a single breakdown after more than 2000 hours operation at a 10 mA load. The use of this tube is reviewed in respect to the physical factors, determination of wave-length, the absorption of the radiation, the dosage and clinical observations in respect to patients. For deep therapy the use of higher voltage results in greater biological action, although the advantage is not so apparent when superficial regions of the body are treated. B. J. L.

***5240. Teleradiographic Unit Employing a Single X-Ray Tube.** *Radiology*, 25. *pp.* 356–359, *Sept.*, 1935.—In teleradiographic work the distance between the X-ray tube is increased in order to minimise photographic distortion. Commonly the actual X-ray tube is supported from the ceiling of the X-ray room. A description and illustrations are given of a particular apparatus, which is not ceiling supported, but allows one tube to perform the double purpose of examination of walking patients in the erect position and of patients when lying in bed. B. J. L.

5241. Biological Action of β- and γ-Rays. Part I. Y. Kimura. *Inst. Phys. and Chem. Research, Tokyo, Sci. Papers, No.* 598. *pp.* 27–47, *Sept.*, 1935. *In English.*—It is well known that large doses of radioactive radiations have injurious effects on living cells. In the experiments described the unicellular organism Paramecium candatum was subjected to irradiation at a short distance (2 mm.) from very weak β- and γ-ray sources—activities equivalent to about 10^{-7} gm. Ra. Details are given of the methods of preparing the cultures and the radioactive materials. The effects of the radiations on the rate of reproduction of the organism were observed. Curves and tables show that continuous irradiation by weak β- and γ-rays accelerates the division rate of Paramecium on the whole, the acceleration being more marked in the ascending phase of the rhythmic cycle. The acceleration ceases when the irradiation is stopped, no after-effects being observed. The addition of sodium nucleate to keep up the division rate has no marked effect on the results of irradiation. The effect is shown to be direct on the cells and not on the bacterial flora in the cultural medium on which the cells feed. Filtration of the radiations with wax shows that the main effects are produced by the γ-rays, the β-ray effect being very small. J. E. R.

5242. Application of Dense Tungsten Alloy in Teleradium Therapy. L. G. Grimmett and J. Read. *Brit. J. of Radiology*, 8. *pp.* 661–665, *Oct.*, 1935.—The production of an alloy of W, Ni and Cu, of density 16·5 gm./c.c., and its γ-ray absorption are described. The mass absorption coefficient of the alloy for heavily filtered γ-rays is the same as that of lead, and, owing to the high density, the linear absorption coefficient is therefore much higher, being 0·87 cm^{-1}. For the protection of large quantities of Ra, the thickness of the alloy required is considerably smaller than the equivalent thickness of Pb. An account is given of its use in the construction of an improved nosepiece for the 5 gm. teleradium apparatus of the Radium Beam Therapy Research. [See also Abstract 2767 (1935)]. J. E. R.

5243. Biological Measurement of Radium γ-Rays. F. M. Exner and C. Packard. *Radiology*, 25. *pp.* 391–402, *Oct.*, 1935.—Some of the conditions leading to uncertainty in the interpretation of the results of the biological measurement of γ-ray intensity are analysed. An applicator designed to avoid these conditions is described. Using *Drosophila* eggs as a test object, the number of "equivalent" or "biological" röntgens per mc-hr. is measured at a distance of 1 cm. from a point source, with 0·5 mm. Pt filter. The value obtained was 5·00 r/mc.hr. This result is to be compared with values ranging from 8 to 11, obtained by indirect physical methods. AUTHOR.

See also Abstracts 4983, 4984.

OSCILLATIONS.

5244. Oscillations in Voltage Regulator Circuits. C. R. Larkin. *Rev. Sci. Instruments,* 6. *pp.* 314–315, *Oct.,* 1935.—It is shown that in circuits using thermionic valves to regulate voltage, as used, for example in the h.v. supplies to Geiger counters, there is always a possibility of spurious oscillations occurring, due to inherent capacities (sometimes to earth) and inductances. Such oscillations, whose presence can be shown oscillographically, introduce variations in the output voltage greater than those which the regulator is designed to eliminate. Among possible methods of overcoming this trouble are suggested the proper spacing of components, the use of separate heating supplies and filtering the output by means of a capacity of the order of 1μF. G. E. B.

See also Abstracts 4974, 5158, 5164.

PHOTOELECTRICITY.

5245. Photoelectric Properties of Pure and Gas-Contaminated Magnesium. R. J. Cashman and W. S. Huxford. *Phys. Rev.* 48. *pp.* 734–741, *Nov.* 1, 1935.—A continuation of an earlier investigation [see Abstract 3256 (1933)] on the effects of gases on the photoelectric sensitivity of Mg. A method for purifying Mg by multiple distillations is described. The threshold characteristic of all gas-free surfaces obtained by successive distillations is found to lie at 3430 ± 20 Å. The threshold value at 5100 Å, previously ascribed to pure Mg, is now definitely attributed to Mg contaminated by H_2. The effects of O_2 are further investigated in detail, a very slight dosing giving rise to a maximum excursion of the long wave limit to about 5700 Å. Calculations show that the formation of polar molecules on the Mg surface will account for the threshold shift observed when H_2 or O_2 is present. AUTHORS.

***5246. High-Vacuum Photo-Cells Using Secondary Emission. P. Görlich.** *Zeits. f. Physik,* 96. 9–10. *pp.* 588–592, *Sept.* 12, 1935.—By inserting a second kathode in a high-vacuum photo-cell, a considerable amplification, arising from secondary emission phenomena, is obtainable, and current potential curves are reproduced. J. E. R. C.

5247. Photo-Conductivity of Rock-Salt Crystals. Z. Gyulai and P. Tomka. *Zeits. f. Physik,* 96. 5–6. *pp.* 350–354, *Aug.* 31, 1935.—The author suggests that the measurements of Arsenjewa [see Abstract 2692 (1926)] are in error owing to the presence of colloid in the crystal. The absorption of X-rays in rock-salt crystals is found to increase with the duration of irradiation, the increase in long wave-length absorption becoming quite marked after irradiation for a number of years. The effect is attributed to the formation of colloid. The photo-conductivity of these irradiated crystals was compared with that of freshly irradiated crystals and found to differ markedly in such a manner as to confirm the above suggestion. J.E.R.C.

5248. Photo-E.M.F.s and Currents in Selenium Single Crystals. R. M. Holmes. *J.O.S.A.* 25. *pp.* 326–329, *Oct.*, 1935.—Cells were made by sputtering Pt electrodes on to thin flat single crystals of Se. Measurements were made of the variation with illumination of the photoelectric current, of the photo-e.m.f. (defined as the potential which must be applied in the external circuit to stop the current), and of the resistance under a constant applied e.m.f.; and of the variation of current and e.m.f. with the wave-length of the incident light. The results are discussed in terms of the resistances of the various regions of the cell. D. H. F.

***5249. Selenium Rectifier Photo-Cells. P. Görlich.** *Zeits. f. techn. Physik*, 16. 9. *pp.* 268–271, 1935.—A number of conclusions were reached concerning the effect of constructional details on the sensitivity of Se rectifier cells. The optimum thickness of the Se layer is 0·08 mm. The annealing of the Se after deposition should be carried out at 218·5° C. The light transmission of the sputtered top electrode must be in a fixed ratio to the electrical resistance. The sensitivity depends on the gas in which the sputtering is done, and is largest for air. Sand-blasting the iron plate on which the Se is deposited increases sensitivity. If Ni or Pt are deposited on the plate before the Se is applied, the sensitivity is ten times as great as when Cu is deposited. D. H. F.

PIEZOELECTRICITY.

See Abstract 5183.

THERMIONICS.

5250. Thermionic Emission of Diffusing Salts Through Copper. J. Cichocki. *J. de Physique et le Radium*, 7. *pp.* 397–400, *Sept.*, 1935.—The ionic emission from a copper leaf filled with a salt and raised to a high temperature (1000° C.) is examined by a mass-spectrograph [see Abstract 1759 (1934)]. It is found that there is a constant loss of energy $\epsilon\Phi$ for Na^+ ions, where $\Phi = 5 \cdot 9 \pm 0 \cdot 3$ V; this is not very different from the ionisation potential of Na vapour, *i.e.*, 5·1 V. No ions of F, Cl and so forth are found when salts of the halogens are placed in the copper foil; thus the emission must be electronic. The saturation currents are measured as functions of temperature and time and the conclusion is drawn that a monomolecular layer, consisting of an alloy of atoms of the diffusing metal, its oxides and Cu atoms is formed on the surface of the electrode. H. M. B.

5251. Contact P.D. between Clean and Oxygenated Tungsten. A. L. Reimann. *Phil. Mag.* 20. *pp.* 594–607, *Oct.*, 1935.—The contact p.d. at room-temperature between slightly electro-negatively contaminated W and W having a most effective O covering was found to be 1·70 V. The contact p.d. at 1500° K. between perfectly clean W and what was probably less effectively O-covered W is calculated to be 1·75 V. Both these figures are to be regarded as only lower-limits to the contact p.d. between perfectly clean and most effectively O-covered W. Loss of electronegativeness of oxygenated W by evaporation of O was first detected with certainty at 1300° K., and above this the rate of evaporation was found to increase rapidly. No difference could be detected between an oxygenated surface formed by exposing previously cleaned W, cold, to O_2 and one formed in O_2 by a hot process. It appears that of the various degrees of O-covering that are stable in a vacuum the most effective in raising the work function is the most complete possible. AUTHOR.

See also Abstracts 4751, 4752.